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The Care and Repair of Books



The Care and Repair
OF
BOOKS

BY
HARRY MILLER LYDENBERG
AND
JOHN ARCHER

1690

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The Care and Repair of Books

CHAPTER I

The Care of Books in General

BOOKS are like children in more ways than one; in their response to care and attention in early life, for one thing, and in their response to heredity and environment, for another. It was the "Autocrat of the Breakfast-Table," was it not, whose first specification for his "man of family" demanded "four or five generations of gentlemen and gentlewomen"? For our "book of family" the same four or five generations of gentle forebears are equally necessary. The book's early life will be happier, its maturity longer, its final disappearance more distant if, like the child, it has found its lines cast among kindly and sympathetic friends and parents. Hygienic living conditions, proper prophylaxis, prevention of disease, are for both more important than medication or drugs. Thoughtful and skillful attention by competent, well-trained, experienced physicians and surgeons is necessary for both.

The child has better assurance of long and useful life if he has been properly clad, has received proper food and attention, has found his lot among people who will care for him and free him from unfair demands on his strength. The book has better assurance of long and useful life if it was brought into the world on paper of lasting quality, paper fitted to the needs the volume must serve, the demands it must

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meet. It will have better assurance of long and useful life if it is clad in protecting garments selected with judgment, cut and fitted with skill, certain of proper food at proper times in proper amounts, brought to appreciative hands as soon as indications of weakness begin to show themselves, treated with proper care and attention when major operations are called for, and housed under conditions most beneficial for such companions, helpmates, friends.

For most of us the book is more like an adopted child than one of our own flesh and blood, since it usually reaches us full grown and mature. Our control over its youth and adolescence is usually slight. Happy the man permitted to stand by and help give shape and form to the child of his brain, to select type and paper, to choose boards and cover stock and end papers, to decide color and weight of cloth or leather, to sketch the lettering and decorations in this form or that.

With most of us the book must be housed under conditions over which we have less control than over many other more material things that enter into our daily lives. Our books are kept in buildings as warm or as cool during the heating season as our wishes or financial means permit. But during the summer the rooms are hot or cool, dry or damp, suffer harm or rejoice in favoring conditions that depend usually on the weather and are happily independent of our control. We all know they should not be too hot or too

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cold, too humid or too dry, but few of us are fortunate enough to be able to control these factors.

Air conditioning. "Air conditioning" is nowadays on all our lips. It usually means that air is cooled in summer or hot weather. We take for granted it will be heated when it's too cold for comfort. Now and then we find "conditioning" applied to temperature, humidity, purity of the air, almost so rarely as to call for comment or query.

Sometimes a factory or industrial plant needs control of temperature, humidity, purity for benefit of the material it works with. When work stops "conditioning" stops. When you find a place where all controls are on all the time, day in and day out, you are sure to remember it.

The ideal for books is a temperature of 65 to 70 degrees, humidity between 50 and 65 per cent, complete washing and filtering to remove noxious gases at all temperatures and all humidities, and this control exercised all the time.

Just how books are affected when the air is "conditioned" (primarily for human comfort) during working hours and left to the tender mercies of Dame Nature for the rest of the day seems not to have been studied scientifically. Is this variation of temperature good for them or harmful? Is it better to let nature take its course or to try to control even for a dozen hours a day? Some day we shall probably

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know. At present we can but observe, watch, guess, speculate.

Sunshine helps free our books from various enemies, but sunshine will soon deaden many modern papers and fade many modern colors in cloth or leather. Darkness protects from harmful effects of direct light, but darkness encourages molds and insect pests. With books or children or most other things the old Greek advice against "nothing too much" is as sound today as when first uttered.

In the following pages an attempt is made to tell about some of the harmful influences that shorten the life of books, to suggest some remedies for cases that appeal for help, to plead for some of the care and attention for these mute but eloquent children of our brains that is given to the children of our loins, to mitigate, if not remove entirely, the iniquities of the fathers visited upon books.

Various suggestions are here set down for the care and repair of books, manuscripts, broadsides, pamphlets, and other forms of the printed or written message. They have been developed from the actual handling of books and caring for books, are set down from experience rather than culled uncritically from other books. No doubt other good methods are mentioned in books or are known as tradition in the guild of bookbinders. The mere fact of omission here is certainly no reason why they should not be tried; occasionally one workman is able to succeed with ma-

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terials and methods that spell failure for his brother at the bench beside him. The real test comes with repeated trials and consistent success.

It is only fair to point out that the methods of treatment here set forth are primarily applicable to conditions prevailing in the temperate zone of this western world, and probably would require adjustment to colder or hotter, drier or more humid countries. Principles of treatment would remain the same; the only changes required would be in details of methods employed to overcome adverse conditions.

CHAPTER II

The Care of Books in the Library

LET us suppose you have your books safely delivered new and fresh for current publications, in "good second-hand condition" for the older works, all well printed in a good face of type impressed on good paper, all protected by boards properly sewed in and properly covered with first-class cloth or well-tanned leather, all the work of competent artisans anxious to show the skill of their hands—a set of assumptions probably contrary to fact in most cases, but well enough to start with as a preliminary survey.

Opening the book. First comes opening the book. Well, opening books is nothing more than opening books, is it not? Nay, not so. Much harm has been hopelessly done to innocent volumes by careless or thoughtless or ignorant or indifferent handling when opening them. Your reader who really cares for books will put the volume on a table, the back down and the fore edges up, will open the front cover, then the back, will open a few pages next from the back and the front alternately, pressing firmly but gently along the inner margins of the pages, thus lessening the danger of breaking the binding between the sections. If the book has been bound properly all this care may perhaps not be necessary. But the danger

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is that careless or improper binding may be so covered up that harm is done before it is discovered. Whether well bound or poorly bound there is not the slightest doubt as to the gratitude for careful and appreciative opening felt by the spirit treasured up within those covers.

Collating. After the book is opened comes collating, not so portentous or imposing a task as the phrase may perhaps suggest. It means merely the making certain that the volume is complete and perfect, usually entailing nothing more than running through the pages one by one to see that all are there and to catch omissions and imperfections. If maps or plates are listed outside the pagination they must be checked for completeness and for proper placing. In early printed books careful checking of signatures and catchwords may be necessary. This is also the time to see if the cover is damaged, if the corners are bent or broken or battered, if the lining is loose. New books go back to dealer or publisher if not satisfactory; with old ones decision as to return or repair will depend on circumstances.

Catalogue, accession, ownership records. Recording and accessioning and cataloguing offer the next hazard. In some private libraries these processes take place in the brain of the owner; in larger collections they become more complicated and more harmful. Some indication should certainly be made as to date of receipt, source, cost, and these notes can usually

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be added inoffensively and inconspicuously but securely. Some owners content themselves with a pencil note on a flyleaf or other blank page, on a margin of a leaf, on a bookplate, others religiously refusing to mark their books in any way and recording the necessary information on the catalogue card, shelf list, or some other similar document. It is a matter for the individual to settle, no council or supreme court having thus far been invested with authority to speak for all of us at all times in all places so far as books are concerned.

A few libraries have bookplates and book traditions that add distinction to any volume once on their shelves. With most, however, it is safe to say that the less the marking the less the danger of harming.

To be sure, if absence of marking increases the danger of theft the decision is simple. Some owners use a code in referring to source and price, adopt a cryptic method of marking ownership by notation on certain pages, and thus lessen the danger of harm to the volume.

The owner undoubtedly has the legal right to add his signature to title page or flyleaf; approval or objection will depend on the point of view of the person making comment.

As to use of bookplate or stamp it scarcely seems too much to ask that a man seat himself before his books and make sure that a plate or a stamp is really necessary. If so, then next, will this do its duty and

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avoid harm even if it doesn't add to the charm of the book?

Advice as to choice of a bookplate is almost as dangerous and useless, quite as futile and fruitless, as counsel to Coelebs in search of a wife. The bookplate, we feel, should be attractive, preferably small and good to look on, befittingly modest and characteristically individualistic, costly but not expressed in fancy, rich but not gaudy, useful as asserting ownership, properly instructive as to previous experience. The owner must eventually accept praise or blame. The onus is his.

Once chosen, the bookplate usually goes on the inside of the front cover, properly demands attention to plates already there, may also ask for a moment's thought about other plates that perhaps may follow.

Stamps. Perforating stamps or rubber stamps are occasionally used, more often in public collections than private. Little defence can be offered except the obvious hope or belief that the book with them is spared a more distressing fate than the one without. At rare intervals there is occasionally found a stamp of size and appearance able to prove they are not necessarily all ugly or forbidding, but it means examination of many to find the infrequent attractive one.

The stamp should be placed with reference to layout and design of the page it is to fall on. No reason why it can not harmonize with its neighbors rather

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than be slung at them helter-skelter by ignorant or indifferent hands.

Life on the shelves. When once these preliminary records have been finished comes the next hazard in shape of the life of the book on the shelves. The shelves should normally be filled, or they should have enough book supports to keep the volumes standing upright. If they are too full it means rubbing and harmful friction, inevitable wear on top of the back when books are pulled down; if not full enough the books will lean to one side or the other, and the bindings will be harmed.

This seems so slight a matter as frequently to be overlooked, but there are no more insidious or harmful enemies of books than the practice of letting them sag on the shelves. If there are any pamphlets or paper bound volumes among the lot their life is certainly neither long nor merry unless they are properly supported.

Of course we today are far advanced in care of books as compared with our fathers and grandfathers. We worship classification, bring together books about the same topic, arrange them alphabetically according to the writer, are happy and content if they are "classified," even if that classification tries to make tall soldiers march in close order with short ones.

A tall book standing alongside a shorter one runs grave danger that its sides will warp and lose shape

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unless some sort of protection is provided. Better move it to a place where it can be physically safe in spite of the system of classification.

Tall books should stand by tall books, short ones by short books. Otherwise there's grave danger of harming both groups.

Book supports. Book supports can be bought from any dealer in library supplies, or any man handy with tools can make them. You need nothing more than an upright held in position firmly enough to assure an upright position to the books next it. Commercial supports are frequently stamped out of a piece of metal cut in the centre and bent to form an upright section. Some have a flange and others not; the former are preferable, since the flange helps prevent the damage done when books are inadvertently pushed against the support as they are put on the shelf. Those with a hook protruding through the bottom of the shelf must be guarded against to make certain they do not harm tall books shelved below.

A homemade support can easily be made by taking a piece of seven-eighths soft wood four or five inches long and four or five inches wide with a two by two by four block set at its base. Or a piece of sheet metal may be set against such a base. In many ways the support used in the old Gore Hall days of Harvard College library can not be bettered, and it was nothing but a common clay brick covered with stout paper. The homemade varieties suffer in competition with

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the commercial supports in bulkiness and waste of space, but to some booklovers their human touch has a distinct appeal as compared with the cheaper and more efficient machine product.

So far as that is concerned any collection will benefit if it has the advantage of attention by a pair of hands that get fun out of doing things, that like to explore the anatomy of books enough to give proper attention to small pieces of repair work, that know how to apply a strip of paste or glue to hold a signature in place or to set back a leaf that is breaking loose, that can fasten a label beginning to curl on one edge and will soon be entirely off unless securely restored once more.

How books should not be shelved. One of the quickest and surest ways to damage books is to shelve them on their fore edges. In any case there is the tendency, with large volumes the certainty, to loosen text from covers. Large books should be stored on shelves deep enough to hold them safely, on shelves fitted with proper supports. No exact figures can be set down as marking the precise size that ought to be kept flat on roller (or smooth metal) shelves rather than stand upright, but there certainly is no doubt that large volumes should be stored in a way to minimize friction in shelving or withdrawing them, should be kept either upright or flat, never half way, should be stored in a way to do no damage to themselves or to others.

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Books in exhibition cases. When books are displayed in exhibition cases care should be taken to prevent their coming into direct sunlight. Pages exposed should be changed now and then. Keep the pages open by a strip of cellulose acetate — be sure it is acetate, not a nitrate such as what we commonly call celluloid — over the page and held in place by thumb tacks at each end.

A thin, light sheet of glass may do if transparent strips are not at hand, but the trouble with glass is that it exerts a constant weight and pressure. It tends to flatten out the opened part of the book too much, even to break the back.

In any case, constant care is necessary to keep the pages free from dust or other dirt. Open the case now and then, wipe the dust off, change the leaf if possible.

If the case is dust proof fear may be set aside as to the effect of the confined air on the paper and other materials in the book. A constant condition of air, in itself, in the exhibition case will do little harm to the contents.

Care in handling books. The private library suffers less danger to books while being handled than does the public collection with volumes bandied about between ignorant readers and thoughtless attendants. Housecleaning or moving does more harm to books in the private home than their normal use under ordinary circumstances. In the large public collections

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they suffer sadly unless subject to constant, intelligent, sympathetic supervision. Few things are more dangerous than stacking books into shaky, unstable piles; a slight jar and they tumble to the floor. Tossing books like tennis balls or chunks of coal may conceivably amuse the youngsters thus diverting themselves, but it gives little benefit to the victims.

Packing. If books have to be moved the ideal is to wrap each volume in good kraft wrapping paper, pack them stoutly to prevent friction or rubbing, handle them and their boxes with thoughtful and intelligent care, treat them with the respect they deserve.

If they are packed back to back, fore edge to fore edge, there is danger of flattening rounded backs. If back must be packed against back, lessen risk by laying sheets of paper or cardboard or other safe packing material in a way to even up the projection of the back. Fore edge of one against edge of the back of the next volume lessens the need of this insertion, but there will still remain the danger of a shift and consequent pressure of rounded back against the plane surface of the other cover. The solution there is to prevent slipping by proper packing and fastening.

CHAPTER III

Some Enemies of Books

SOME enemies of books can be seen, and methods of control or remedy are obvious. Some of the most insidious, persistent, voracious, insistent attackers, however, can not be seen in operation, though their effects and results are plain even to the blind.

Harm from the air. The air we breathe may be one of the worst enemies of the books we collect. It harms if too dry, it harms if too wet. When books are kept in rooms with air too dry their paper and leather turn brittle and begin to crumble. This should not happen, to be sure, and would not happen if paper and leather had proper resistance.

Paper books and leather bindings have for ages existed in dry climates with no serious harm. But paper and leather of these later days are made to sell rather than to last; cheapness is more essential than permanence.

Paper and leather and cloth for books play so small a part in the whole field of paper and leather and textile industry in the modern world that they are in no position to insist on obedience to their demands, even if these demands were sharply enough defined to be formulated. The book world therefore can do little more than take what is given to it in the general field, fortunately finding here and there a

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papermaker or a tanner who still has enough pride in craftsmanship to look on his calling as something more than a mere means of daily bread.

Good paper and good cloth and good leather can be had by anyone willing to pay the price properly demanded by any workman called on to produce anything different from the ordinary. But such efforts are costly.

Harm from dampness. This is all however very general as a comment on current conditions in the world of the making of books, and the specific question is what a book owner can do to keep his library from becoming too damp or too dry.

Too much dampness means mold and mildew, loosening of paste and glue, weakening of fibres of paper and leather. This however is so unusual a situation outside the tropics or away from fogbound seacoasts that few readers will probably be called on to meet it. The remedy is removal of the humidity by artificial heat or by increased circulation of dry air. Frequent wiping of books with dry cloths, frequent treatment of leather bindings with some of the preparations mentioned in Chapter VI on Preservation of Leather Bindings, will serve as palliatives, but the best method of meeting the situation is artificial or natural control of humidity.

Harm from dryness. Most libraries in the United States and Canada will have more trouble in fostering and cultivating humidity than in driving it away.

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Most of us give more heat than is good for books, dry heat that drives the life out of paper and leather, dry heat that calls for mitigation of its dryness by means of artificial moistening of the air. This is largely a matter of attention and thoughtfulness and care in the ordinary household, or artificial conditioning of air in larger structures and institutions.

If a house is heated by a hot air furnace it usually is simple to add hot water to the air as it leaves the fire-box. With steam and hot water heating other methods must be used. Various devices are on the market for attachment to radiators to be filled with water and thus increase the humidity by evaporation. Some are simple, requiring little more than a daily thought to keep them filled; others are more complicated, occasionally more effective, certainly more exacting of time and attention. Some librarians have found satisfactory results from setting wet sponges in copper receptacles under their book cases. Others have turned to open vessels treated as furniture or pieces of ornament.

As a matter of fact the means is less important than the end, the securing of an average humidity of fifty to sixty or sixty-five per cent. A hygrometer or wet and dry bulb thermometer costs little and is simple to read. Occasional use of it, followed by efforts to take advantage of what it tells as to conditions, will benefit any collection of books.

Bear in mind, however, that much water has to be

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evaporated to affect the humidity of a room heated to 70 degrees in cold weather. Keeping the temperature down is an excellent way to keep the relative humidity up.

Polluted air. It is more difficult to ward off the attacks of noxious gases, more difficult to learn of their presence before their fell effects show themselves, more difficult to remove them or keep them out, quite as difficult to repair their ravages.

Theoretically it is possible to care for such situations by conditioning the air, but this is a counsel of perfection possible only for buildings with ample mechanical equipment attended by intelligent and sympathetic and competent engineers. Even then it is largely a question of opinion as to the success of the equipment.

For the small householder the only refuge seems change of residence. If he lives near a laundry or smelter or power house, or any one of a dozen other lethal instruments developed by our advanced civilization, he may be sure that day by day and hour by hour their chimneys and smoke stacks belch forth gases that pollute the air and are certain to take their toll of anything in his house composed wholly or partly of leather or paper.

The city dweller is of course in a much worse situation in this respect than his brother in the country far removed from evidences of modern industrial progress. Community control of sewage disposal has

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progressed farther than community control of atmosphere pollution. An owner of good books who realizes he is living in a region subject to this air pollution will do well to think about his responsibility toward his books as well as toward his family.

In 1929 a study of the effect of city air on books stored under the usual library conditions was recommended by the American Library Association, and the Carnegie Corporation agreed to finance the project by a grant to the National Research Council for fellowships at the Bureau of Standards. This grant was supplemented by others included in the regular funds for the Bureau appropriated by Congress.

Work started on August 26, 1929, and was stopped by the exhaustion of available funds on July 26, 1933. The results of the studies appear in the "Summary Report of the Bureau of Standards Research on Preservation of Records," by A. E. Kimberly and B. W. Scribner, Bureau of Standards miscellaneous publication No. 144, issued May 9, 1934. The work was not completed and it is hoped that some way may be found to resume operations.

Air borne disease germs. Disease laden air is not frequently charged with blame for damage to books. Just how much harm can be done to books by air borne disease germs is doubtful. An eye is frequently cast askance on books used by the sick or on the books housed in rooms where sickness has laid its hand. It is perhaps not unnatural to assume that mod-

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ern precautions would recommend disinfection, but medical opinion frees books today from blame as carriers of disease. This is particularly true in case of such afflictions as chicken pox, mumps, German measles, scarlet fever, diphtheria, and the like. Transmission is possible if (1) they are grossly contaminated with infectious material from a patient, and (2) this material is transferred within a few minutes to a susceptible contact.

They should be burned after exposure to small-pox or anthrax.

Health authorities do not now quarantine books or expose them to fresh air and sunlight for forty-eight hours, as was the general practice not so long ago.

Tuberculosis. Every now and then some earnest soul feels oppressed by the dangers to the community from books belonging to public libraries used by persons suffering with tuberculosis. The consensus of opinion now held by competent medical men seems to be that tuberculosis can not be spread in this way.

Bedbugs and cockroaches. If bedbugs or cockroaches have taken a fancy to books exposure to the sun is usually sufficient to drive them away, for these pests thrive on dampness, darkness, warmth. Sunshine however will not solve the problem of destroying the pests in their homes or sterilizing eggs or larvae. For this the safest step is to expose the books to some such

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agent as paradichlorobenzene in an airtight chamber.

Bookworms and borers attack boards and paper, roaches eat the filler of the book cloth. Rats and mice eat the paste and glue.

Other vermin. Vermin like these are infrequent if not unknown in light, well-ventilated rooms. They come sometimes in shipments from the tropics, and books from these regions should be quarantined before being shelved. Open the parcel in sunlight, for gentry of this sort have no love for the sun. If adults, eggs, or larvae are found immediate action is called for. Kill the live ones, isolate the infected volumes, spray thoroughly with a solution of carbon tetrachloride. This is a colorless liquid that does not stain.

Place the books upright, open the leaves partially, using any approved spraying apparatus, obtainable in department stores or from dealers in household supplies, and try to reach the back edges but be careful not to wet the pages too much.

Any good insecticide, liquid or powder, may be used, but be sure it has been tested against discoloration of paper or book cloth. It may be necessary to call in a professional exterminator, but make sure beyond doubt that he has had successful experience elsewhere with books. Your library is no place for trial of his 'prentice hand. These professionals may usually be found in large cities. In smaller places it may be necessary to rely on local hospitals or the

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local health officer. No need to say a fumigant or disinfectant, such as formaldehyde or corrosive sublimate, should never be used except under conditions assuring perfect control of agent and apparatus.

Mildew or mold. Mildew or mold is a direct result of dampness, high humidity. It is a thin, whitish coating consisting of fungi of many kinds, and its action is unbelievably rapid. The best remedy is prevention, and the best method of prevention is storage in light, well-ventilated rooms where the books are kept dry.

All easy enough to say, to be sure, but what help has any owner of books against the humid heat that occasionally sweeps down on hapless residents of the southern and east seaboard of this continent?

Well, for one thing, he can shut the windows and turn on artificial heat, no matter what the thermometer says as to outside temperature. He must first drive away the humidity. Heat may be uncomfortable, but if it is dry the mold will not spread. Then rub the books with clean, dry cloths, and keep careful watch to see that no advance takes place. Most cases of mold or mildew can be removed from paper by alcohol if the stain is on the surface. Once into the fibres the case seems hopeless. The British Museum uses thymol for sterilizing.

Dusting and cleaning. One of the most malevolent hostile acts books suffer from is well-intentioned dusting or cleaning. Books ought to be kept clean, of

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course. No lover of books wants fingers or clothes or anything else to soil them. But no lover of books can ever think with any other emotion than horror and dread when he falls back or looks forward to their fate during the spring or fall housecleaning that splits so many happy families in this fair land. Dust on books may be unpleasant, but it certainly can do no such harm as the banging and thumping they get on these annual or semiannual incursions or on the weekly or monthly attacks of housekeepers and housemaids.

A vacuum cleaner will remove dust, granted that the cleaner is properly designed and is fitted with a proper brush for work of this kind and, in addition, is handled with a modicum of intelligence and thought. Dust cloths, with a slight sprinkling of oil, will remove the dust and prevent its being spread. Here, as in various other processes, the instrument is less important than the judgment that governs its use. Further study in this field of dust removal as applied to books may well be made.

If it should prove to be a choice between permitting dust to accumulate and seeing the shelves and books "cleaned" in ordinary slap-dash fashion there is no doubt as to the wisdom of choosing the former. How successful the owner proves to be in carrying through his choice is largely a matter of personality. Uncontrolled cleaning zeal can do much harm to books.

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Regular supervision. Just as guardians of public and family health are more anxious nowadays to insure proper precautions and to develop preventive medicine than to indulge in heroic measures of restoration after disease has set in, so the owner of a library will fare much better if he has the books examined now and then by a workman competent to repair slight defects before they develop, and to help these mute companions of his quiet hours, these brave helpers in his efforts to spread knowledge of human life and thought, resist the harmful influences that snap at them from every corner of the room and from every pair of hands stretched toward them.

It is an easy matter to see that leather bindings are kept in good condition; or, at least, it is much more easy to start afresh and see that they do not go backward, than it is to repair the damage when once it has begun its wicked work. Find a competent person, set him at a systematic examination of shelf after shelf, let him patch here and repair there as the patients call for help and attention, and at the end of the year the books will be in much better condition than if the need of binder's care is called to mind only when the case is so striking as to shriek its demands.

CHAPTER IV

The Repair and Mending of Books

SKILL in mending books depends to a certain extent on the knowledge the mender has of the way books are made. The more one knows about book-binding materials, leather, paper, cloth, thread, paste, glue, the better the chances of success. How will the paper wear? Is it brittle or tough? How do paste and glue affect it? Knowledge of these and similar points, joined to practice in mending and repairing, will help mightily.

One is sometimes tempted to extend Punch's advice about marriage to the problem of mending books. Many books, to be sure, repaired by inexperienced hands, have been so sadly harmed that their old age is much worse than their youth. Far better to set them aside and wrap them up till they can be turned over to competent and understanding hands. But in many cases the life of books can be materially lengthened if intelligent first aid is given as soon as signs of ill health appear. After a book begins to break, its lesions call for practiced care and attention quite as obviously as torn skin or broken bones on the human frame. Book anatomy is not so complex or intricate as that of the upper vertebrates, to be sure, but the surgeon must have sympathy and training whether treating books or man.

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Anatomy of the book. There is no reason, however, why the average collector and lover of books should not make minor repairs—after he has learned how books are put together. His introduction to book anatomy should begin with dissection of useless cadavers rather than with attempts at vivisection. Take an old book obviously on its way to the waste basket, and see how much you can learn by study of its construction before you begin to use the knife. Note how the board or leather covers or backs have a layer of cloth or paper pasted over them for protection and ornament. See how the back is sometimes the same sheet as the cover, sometimes is another sheet of leather or cloth. Learn how the covers are fastened to the book; in older books you will find the signatures, or gatherings of leaves and pages, are usually sewn on bands or cords that are laced into the side covers, and in modern books you will see this connection is merely a thin sheet of "super" or muslin glued to the signatures on its one side and to the boards on the other. Come to know the difference between the sewing of signatures on cords and the overcasting of signatures to one another by stitches that may or may not hold securely. See whether the plates are tipped in or are folded in. Careful study and observation will help avoid many mistakes in attempting repairs.

When repair work really begins one of the first things needed is glue or paste. Books may be made

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without paper; many are made of leather or vellum and little else. Books may be made without cloth or parchment or binder's boards. But it is difficult—not to say impossible—to make them without glue or paste. And it is not easy to find any substance entering into the making of books we know so little about as we do about glue.

Glue. Glue is an organic substance obtained from skins, hides, bones, sinews of neat cattle, sheep, horses, and from other animals; some comes from the heads and bones of fish. Hide glue is usually supposed to give best adhesive qualities. Glue differs from paste in that it can be made to remain flexible when dry. Paste always dries brittle. It is the addition of glycerine and other elements that permits glue to dry flexible. Because it contains less moisture in its usable state and because it dries more quickly after application, glue has advantages over paste in various kinds of work. For the backs of books flexible glue should always be used. It will dry and remain strong, elastic, capable of bending without cracking. Paste would be brittle when dry. So too the joints will soon crack, sometimes break, when they are opened or shut if a hard, brittle glue has been used. A high-grade glue will have less odor, will be stronger, will cover more space than one of poorer quality.

Glue is usually bought in flakes, sheets, cakes, or pulverized form. It is heated in a gas or electric pot, and it should be softened by soaking in water before

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applying heat. As it burns easily, a double boiler type of pot is usually best for heating; the danger of burning is thus avoided, and the hot water retains the heat even after the original heater is turned off. The commercial bindery uses glue pots or glueing machines, which permit heat to be supplied constantly with accurate measurement or adjustment.

Paste. Paste is made from flour obtained from the grains of rye, wheat, corn, rice; from the husks, cobs, stalks of some of these plants; from various starches, dextrans, and sometimes from gums. It is one of the first essentials in any bindery. It differs from glue in having a greater moisture content, in drying more slowly by evaporation as contrasted with the quick setting of glue as it cools. Paste is usually white, or nearly so, and it does not stain as glue is likely to do.

When to use paste or glue. The experienced binder is never in doubt as to when to use glue or paste. The latter is chosen for paper and soft cloths, such as cambric, canton flannel, silk; for casing-in books, for end leaves, for mending and repairing torn pages. Glue is used for the backs of books, and for colored or sized book covering cloths. If paste should be applied to some book cloths it would soften the cloth and remove color, size, grain, this because of its moisture content. Binder's boards and leather permit either glue or paste, with due consideration to the kind of work and the results desired. On books bound in quarter or half leather flexible glue is used. Books

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bound in three-quarter leather or full leather, with raised bands, call for paste, because it is slow in drying, and because it softens the leather with its moisture and permits the binder more time to handle the whole process. With books of this kind glue would prevent satisfactory handling of the leather, because it dries so quickly that the binder would not have time enough to stretch and pull and form the leather.

Making paste. Paste may be made out of flour and water, the success of the effort depending largely on the skill and experience of the hands that do the mixing. In general it will be simplest to buy the paste on sale by any reliable stationer or dealer in library or bindery supplies. The only difference between the paste you make and the paste you buy is that the commercial paste has a bit of preservative added to prevent its becoming rancid. If the cover is kept on tightly and water is added now and then, the paste will probably keep in good condition as long as any is left in the container. It will cost a few cents more than paste made from household flour, but the slight additional expense is far offset by greater uniformity and more general satisfaction.

For a larger supply, or for the satisfaction some of us get out of actually seeing things grow and take shape, paste may be mixed in any convenient bowl. Begin on a small scale and take about half a cup of flour. Add cold water gradually, stirring constantly until water and flour are blended, all lumps smoothed

out, the mixture just about the proper consistency for gravy, for instance, not so fluid as soup nor so viscous as bread dough. Then add boiling water, put on the fire and bring the mass to a boil for about one minute, stirring constantly. If it becomes too thick add sufficient warm water to bring it to proper consistency. Count on its thickening ten to fifteen per cent, as it cools. It should not run so freely as milk, should not be lumpy, should not be so stiff as to fail to run from the brush with moderate ease. Starch may be used instead of flour, entirely a matter of preference, price, convenience.

Dry paste can be bought in pound packages and larger quantities, requiring little more attention than adding water, and stirring. This is what most paper-hangers use. The commercial binder frequently mixes his paste in a machine, using special flour that permits adding hot water at once; but he uses paste in quantities far beyond the needs of the reader who turns to this book for help.

However, even if commercial paste is more satisfactory, do not adopt it exclusively until you have made enough paste to satisfy yourself that you actually can make it. Even if you buy your paste you will be in better command of the situation if you know how to make it. You certainly should learn by experience how much moisture is best for your work; the drier the paste the less danger of wrinkling, but if too dry it will not bind.

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In using paste remember that the less you use the better. The normal tendency is to use too much. A thin coat of any adhesive firmly pressed into the pores of the objects to be joined will hold the sheets more successfully than a thicker lot that has little more than its own portions to stick to and rapidly grows weaker and more brittle the drier it gets.

Remember too that paste contains moisture, which means that the pasted sheet has a tendency to curl or wrinkle. Pressure is needed to force the paste into the paper fibre for one thing, and for another to keep the paper smooth while it dries. If too much is applied some of it will squeeze out beyond the edges, which may cause other pages to stick together or may soil portions difficult to clean. Experience and experiment will show when there is too little or too much, when it is too thin or too stiff. The more practice on books and paper that mean little the more certain is good work on books and paper that mean much.

Mucilage is possible too, but had better be used only if nothing else is available and action can not be deferred. It is an aqueous solution of gum, or of allied substances, is affected by weather conditions, is less effective than glue or paste properly applied.

Paste may be applied with thumb or finger, if nothing better is near, but in the long run a good brush pays for itself. Paste brushes are made of the hair of horse tails, pigs, wild boars, the latter the best.

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They are softer than glue brushes, flat rather than round like glue brushes, need little care and attention other than regular cleaning after use, and ought to last for a long time. Hang them up when not in use, or keep them flat, to avoid forcing the hairs to take a "set" and get permanently out of shape.

Repair equipment. And that brings up the question of materials and equipment in general. First comes a table. Any kitchen table will probably be satisfactory; all one needs is a level, smooth working space fixed at convenient height, 30 to 36 inches from the floor, depending on whether you prefer to work sitting or standing. The materials noted below may be secured from any supply house dealing in book-binding materials. Some dealers in library supplies sell repair kits and mending outfits put up in handy and attractive containers.

Here is a list of some of the things helpful in repair of books:

- bone folders, 2 or 3
- knives, one with the usual cutting edge, one with bevel edge for paring
- scissors, one with 5-inch blades, one with 7-inch blades
- sheet zinc, for cutting cloth, leather and paper
- straight edge, about 18 inches long
- plate glass sheet, about 18 inches square
- paste brushes and paste pot

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sponges, several
book paper, several kinds
blotting and wax paper, several sheets
tissue paper, for mending
cambric and book cloth, several yards
press, about 12 by 15 inches in size
weights, which can easily be made by covering
bricks with stout wrapping paper

Torn pages. Torn pages probably mark the first injury to a book, and they may be mended in any of the following ways:

If the tear does not affect the printing, cut a strip of thin, tough paper half an inch wide, a little longer than the tear. Cover the strip with paste and then lay it carefully on the paper over the tear, being sure to see that both edges of the tear have been brought together evenly. The strip should project slightly beyond the tear on the sound side of the paper and slightly beyond the edge also; trim the overhang along the edge with a pair of shears or scissors. A good way to paste mending strips is to spread the paste evenly on a piece of glass (preferably plate) and lay the strip on it. Lift the strip and enough paste should adhere to it, just enough, not too much, nor too little.

When the tear extends into the print put a small bit of paste on the torn edges and place them together. Then take a piece of soft mending tissue pa-

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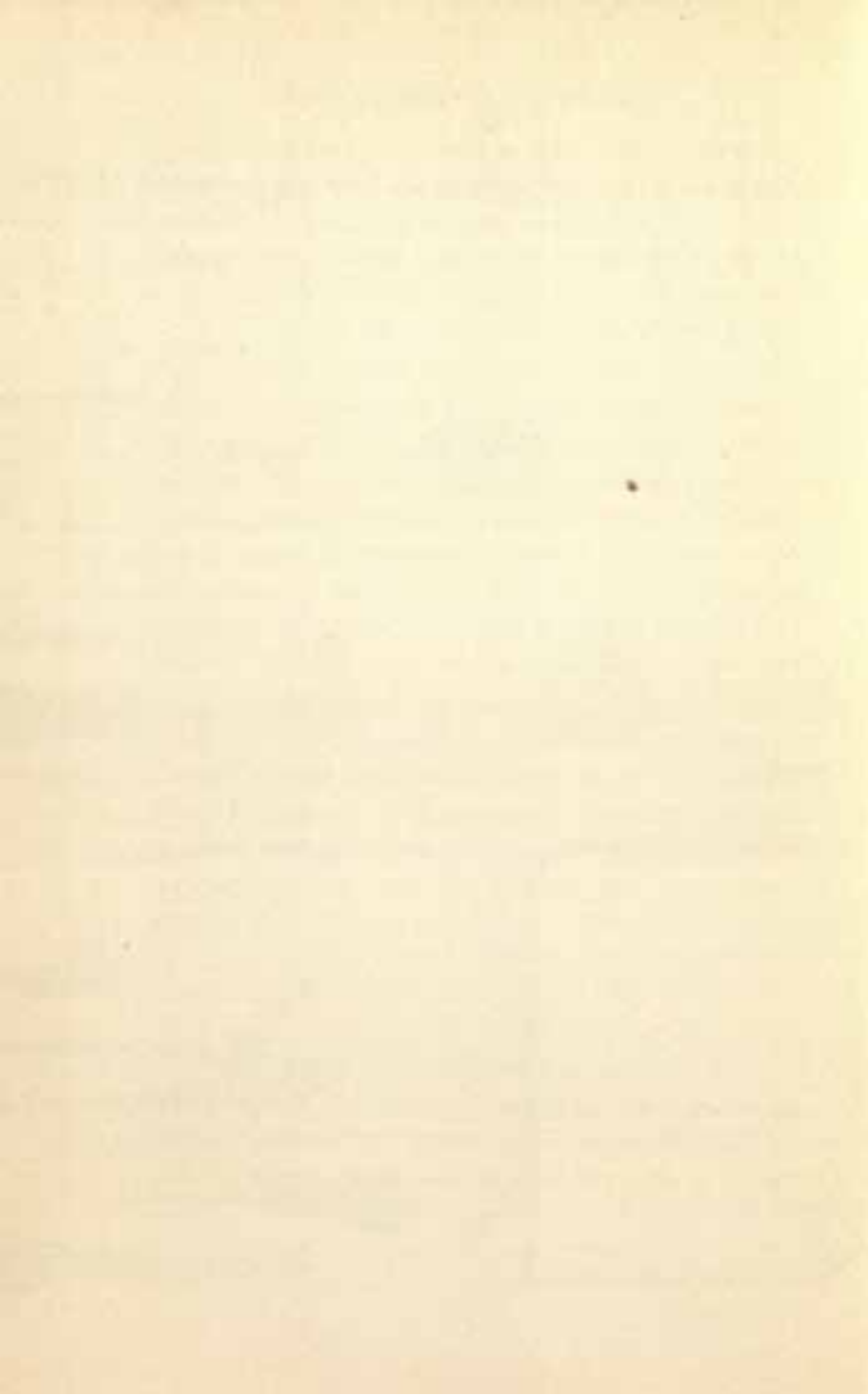
per and rub it gently over the tear in a way to make the tissue adhere to the torn edges. Then put it into press or under a weight until it is dry. Tear off the superfluous tissue, taking care always to pull toward the tear from both sides. The delicate soft fibres of the tissue act as a binder, and when the task has been well done it is almost impossible to see how the mend has been accomplished. Here again it is practice that counts, and the first efforts should be made with books and torn pages that can afford to be spoiled.

Repair of newspapers. The private library will but rarely have newspapers to be treated, and under ordinary circumstances such volumes should go to the professional binder. He will be best able to tell whether the cost of the repair is worth the effort. For the amateur gummed tissue stands out as first-aid material, but this is particularly a case where restraint is necessary. The normal tendency is to use it on everything, books, newspapers, periodicals alike, and the danger is that it will show a yellowish color, darkening with age. It is safer, though less easy, to use tissue paper and white flour paste.

PLATE I. SOME TOOLS USED IN BOOK REPAIR AND RESTORATION.

1. Color dish. 2. Magnifying glass. 3. Small dish for color or paste. 4. Sandpaper block. 5. Earthenware cup. 6. Sponge. 7. Enamelled tray. 8-13. Steel scrapers, creasers, probes, etc. 14. Bodkin. 15-20. Brushes. 21, 22. Tweezers. 23, 24. Dividers. 25. Knitting needle. 26, 27. Awls.





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Printed or manuscript sheets will often be given longer life if they are covered with some protecting fabric. This means lessening of legibility, to be sure, but the protection of the surface is usually well worth that price. And the legibility need not be reduced to an improper extent if judgment and care are used.

Covering with silk or tissue paper. Though this treatment may, in cases of emergency, be given sheets in a bound volume the ideal is to take the book apart and handle the sheets flat. Silk or tissue paper may be used. Silk costs more and does less harm to legibility. Tissue costs less, is not so transparent as silk, gives more protection from the air. When either is used both sides of the page must be covered; otherwise it is certain to curl, due to the unbalanced pull of the covered side when but one side is treated.

Paste. For an adhesive make a paste from pure wheat or rice flour, neutralizing it in color by a small quantity of tapioca dextrine. The thinner the paste the better. Too thin it will not bind, too thick it shows lumps and gives an uneven result. Experience and good judgment are the only guides. Some paper calls for thin paste and some for thicker.

Silk or chiffon. Spread a thin layer of paste on a sheet of glass. Lay a sheet of chiffon (about an inch larger in all directions than the sheet to be treated) on the pasted glass. Give this sheet another coat of paste and lay the paper on it, using the paste brush to smooth it down and insure complete contact. Give

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another coat of paste, and then lay on the second sheet of chiffon, carefully smoothing it down with the brush. Next strip all three sheets from the glass, an easy and simple task for the experienced hand, but not so lightly undertaken by the beginner. However, if previous warnings have been followed, the first trial at this sort of work will be with material of no great importance, and it will call for no great amount of effort before one begins to get confidence and to handle the wet, sticky sheets with ease and assurance. Hang the sheet on a rack, frame, or line already provided. When it is half dry place it between wax boards, put it to press for half an hour, strip the sheets from the wax boards, put them between new wax boards till fully dry, and then press them once more, overnight or for several hours. When dry the overhanging edges of silk should be trimmed even with the paper.

If there is much mounting or patching to be done it may perhaps be best to finish that part before beginning to paste the entire sheet. Slight repairs may be made while the sheet is on the pasted glass before the final sheet of silk is laid down. There is danger here, however, that the paste may dry and spoil the job. Here again experience must be the teacher.

Tissue paper. The process is about the same when using tissue paper, except that pasted sheets are hung up to dry instead of being placed between wax boards and blotters. They are pressed when fully dry, and

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run through a heated mangle to press them still further and to make them as smooth as possible.

Dealers. In the larger cities silk and paper for this purpose can be secured from wholesale dealers in textiles or paper, either direct or through a dealer in bindery supplies. In smaller places the binder will probably have to turn to his jobber or general supply house.

Other transparent materials. It is not impossible that help in solving this problem of covering paper may be found in the use of cellophane or some of the other similar transparent materials made from cellulose. At present, however, all it seems safe to say is that if they do help they also call for development of a new technique in handling. They have not proved satisfactory when used in ordinary fashion by trained and competent workmen experienced in traditional binding processes. Time and experiment may develop the solution.

From Boston comes the cheering report that special machinery there gives every indication of success, but it is not easy to find satisfactory specimens of material treated in this way now standing the test of everyday use. Good wishes and earnest hopes of success must certainly be extended by all users of books and book papers to the optimistic inventor and aggressive developer.

But, to go back to mere methods of binding, remember — it can not be repeated too often or empha-

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sized too much—that whenever paste is applied for mending, the sheet or the volume must be put in press or kept under a substantial weight until it is completely dry. Wrinkling is otherwise inevitable. To keep the leaves from sticking together use waxed paper.

Loose leaves. Loose leaves may be inserted in several ways. One is to lay the leaf flat on the table alongside the book. Cover it with a sheet of waste stock, except about one-eighth of an inch along the inside margin. Hold the covering sheet carefully and run the paste brush along the margin; the covering sheet will prevent the paste spreading over the page. Lift the waste sheet and place the sheet for insertion inside the book so that the pasted edge will adhere to the adjoining leaf in the book. Protect the pasted portions by waxed paper, and press till dry.

If the page to be inserted threatens to project beyond the fore edge when finished the obvious remedy is to cut off the projecting part. A better plan is to fold the inner margin slightly, say about one eighth of an inch, paste the turned-over part, insert and press. This has the advantage of using the fold as a hinge, which is, however, dangerous and inadvisable if the paper stock is brittle, weak, or poor. In such a case it will be best to cut the leaf and bind it to the stub by means of a paper hinge or thin cloth.

Repairing corners. With a page that has lost a corner try to get a sheet of paper of the same stock,

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weight, color as the remaining portion. Lay it under the sheet and with a pencil lightly trace on it the outline of the missing part. Then tear it in a way to give a corner with two straight edges and an inside edge roughly following the pencil line, this corner to have its inside edge about one-eighth of an inch farther from the outside than the pencil line; the torn part should show an irregular bevel or feather edge. Paste the bevel edge, lay it on the corner, protect the sheets with wax paper, put the book to press, and trim with scissors when dry.

Filling holes. If a page has had a hole torn in it, losing a picture or part of the text, for instance, the ideal is to replace it by a perfect copy of the same page from a book otherwise imperfect. If no such page can be found the hole may be filled by a "window" of onion skin or bond paper. Take a sheet of this kind of paper, lightly mark on it the outline of the tear, bevel the edge of the original page and the replacement sheet, paste, join, protect, and press. The "window" or inlay thus made will prevent further tearing as the page is turned.

Loose covers. Sometimes new books, fresh from the publisher, show loose covers. Perhaps the paste dried in the machine, and the book went through before the fact was noticed. Perhaps it fell on its edges, or perhaps it was opened roughly or was bent too much in the middle. Open the volume carefully, and spring the hollow back of the cover away from the "bone"

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of the book. If there is space enough use a long thin brush to apply paste. If the opening is too narrow for this get a knitting or crochet needle to carry the paste to the parts that need it. Close the volume, rub the back with a bone folder, and put it away to dry.

Hinges and joints. It is at the hinge or joint where a book gets most wear and strain. Every time it is opened friction and tension are set up in the hinge. The basis of the hinge or joint is the material connecting the body of the book with the covers. Formerly the book was sewed to cords that were laced into the covers, and it was these cords that were flexed every time the backs or covers were opened or closed. Not so long ago came the discovery that manufacturing costs would be lessened and manufacturing time would be speeded if book and covers were connected by means of thin cloth, called "super," glued first to the "bone" of the book and then to the insides of the cover boards. This strip of "super" is ordinarily about as long as the book is high, and is wide enough to project about half an inch or a full inch beyond each side of the back. It has but little strength, is thinner and more frail and fragile than cheesecloth, and pleads eloquently for care and attention when the book is handled. If to this weakness and thinness weak or brittle glue is added it is plain to the blind that expectation of life is short.

Recasing. When this "super" gives way and the book breaks away from its cover the usual thing to

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do is recasing unless complete rebinding is necessary. The first step is removal of all cloth, paste, glue from the back. Sewing should be examined to see that it is intact. End papers should be stitched on the back and front. Take a piece of medium weight canton flannel or muslin as long as the book is high and two inches wider than the back. Paste this to the back, which has just been given a coat of flexible glue. The cloth, if properly put on, will extend one inch on both sides of the back. It must then be rubbed down smooth and firm with a bone folder, and put aside till dry. End papers and projecting pieces of cloth must be trimmed flush with the book. Lay the book in its case, open front cover, paste end paper, close and open the back cover, pasting the other end paper, close the book, put it between boards and into press till dry. To prevent end papers sticking to each other put wax boards between them and the text, both front and back, before putting the book to press. This "recasing" is a pretty piece of work when done by competent hands. Sober old age advises, however, that cheap and unimportant volumes be used for experimenting.

Loose backs. That is all well enough for a present-day "trade" book, but if the volume has a modern loose or spring back different methods must be followed. A tube or loose back must be made by folding back on itself several times a strip of strong hardware or kraft paper, just as long as the book and wide

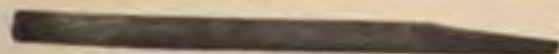
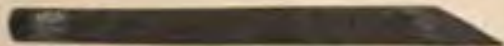
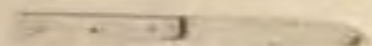
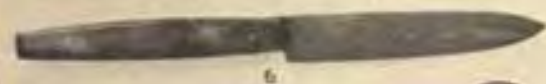
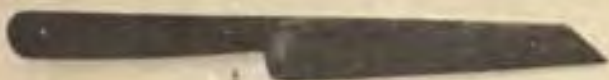
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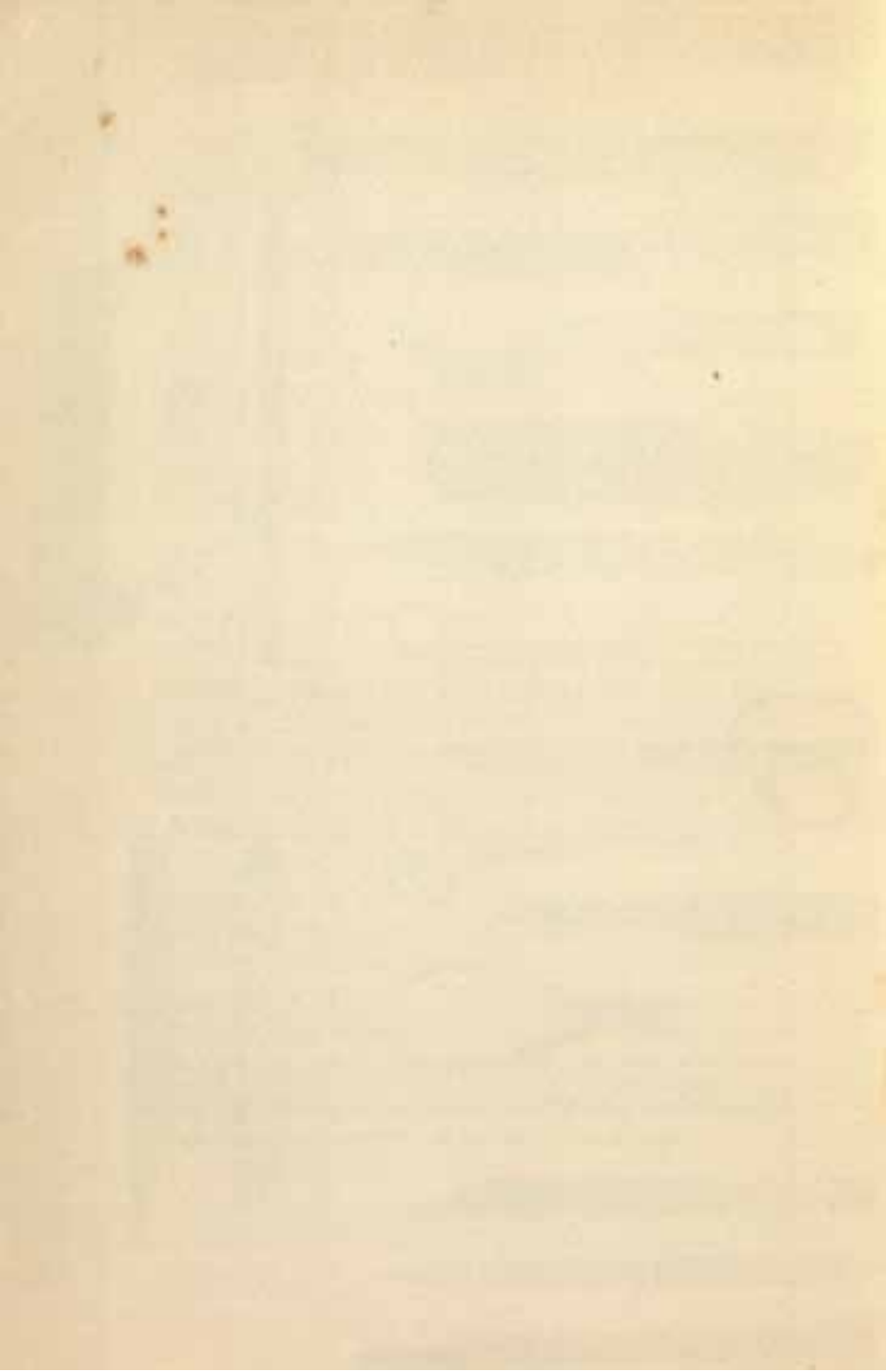
enough for three folds. First cover the back with glue, and lay this strip of paper on it, edge of the paper along one edge of the back. Rub it down smooth. Fold the paper back on itself and run a narrow (say, about a quarter inch) line of glue along the exposed edge of the sheet as glued to the book. Use this glue to fasten the part of the paper just folded back to the edge of the sheet first glued to the back. Then fold the sheet back once more, this time along the original edge, gluing this folding to the sheet formed by the second folding. You thus have one part of the sheet glued to the back, another part folded back on this first part, a third part glued to the second part, the first part and the second part being free except at the fold and the edge where the two are glued together. Cut off any part of the sheet that projects. Open the free part with a bone folder, and you have the foundation for your hollow back. It is not quite so complicated as it sounds, and if you can watch a binder do it once you will have no difficulty in following him.

And now for the back. Glue a strip of cambric or muslin two inches wider than the back to the out-

PLATE II. SOME TOOLS USED IN BOOK REPAIR AND RESTORATION.

1-6. Knives for cutting cloth and leather. 7-9. Scissors. 10. Lance point knife. 11. Sharp-nosed cutting pliers. 12. Thin-bladed paper knife. 13-15. Mount cutting knives. 16, 17. Folders and creasers. 18. Small bookbinder's hammer. 19-21. Folders and creasers.





side of the thrice folded strip of paper. Then paste the new leather back to the cloth, and you will have a loose back on the book instead of a tight back.

Tight backs. Tight backs are usually found on old books, loose backs generally mark more recent binding. A tight back is stronger than a loose back, but it can not be used with cloth bound books, because the flexing as the book is opened cracks and creases cloth, whereas leather in good condition is supple and flexes easily. A thin volume on thin paper will do better with a tight back, a thick volume on thick paper will stand up better with a loose back.

Rebacking. Sometimes the call comes for rebacking and rebinding, usually in the case of books of special interest for any one of a dozen reasons. Little more is called for than experience and skill on the part of the binder, two things easy to call for but less easy to secure. If he knows his business he will remove the original cloth, the end papers too if necessary, though this adds to the difficulty. The signatures may then be resewed or individual sheets repaired, as the case may call for. New backing is then applied, new boards or covers provided, and the old cloth and end papers pasted to the boards.

Sentiment—or other considerations—sometimes calls for use of as much of the original cover as possible even if parts are worn or broken. In such a case the volume is rebacked or rebound, as much of the old cover replaced as is consistent with good work,

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and the vacant spots merely proclaim that a piece of restoration has been done. A good piece of craftsmanship deserves praise so long as no attempt at deception has been made. Repairing books is commendable, honest restoration is praiseworthy, work of this kind done to fool the unwary speaks for itself.

You may, however, have a book bound in leather, and for one reason or other wish to save the old leather on the back and the sides, replacing the worn leather in the hinge with the new. Or, you may find the old leather so far gone as to make it impossible to use it, but you want it replaced with new on back and hinge.

Saving original leather backs. In such a case the old leather must be taken off as carefully as possible. If the book has a loose back the problem is simpler than if the leather is glued tight to the back. It likewise is simpler if the volume is comparatively modern than if it is one of the old-fashioned type with signatures sewed to cords or raised bands. Lift off the old leather with a thin, flat knife, and set it aside for future use if fortune favors and permits removal entire with no breaks or tears. Sometimes the leather is so old and brittle that breaking is inevitable, but sentiment or other consideration calls for its return to the volume. It is then removed in pieces as large as possible, these pieces being set aside for reassembling later and pasting on the back.

The leather is now all off the back or bone of the

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book. Next comes the work on the leather on the boards or sides. This is then lifted up with a thin, flat knife if there is any danger of breaking the skin by use of the ordinary bone folder. At this time it may be well to lift up the parts of the end leaves that cover the turn-over part of the leather. Moistening the end sheets will soften them and permit their being turned or lifted up without harm.

And now for the replacement. A piece of new leather should be chosen, as near the old in color and texture as possible, two inches wider and one inch taller than the old back. Pare its edges, a little more at top and bottom than along the side. Then give it a coat of paste—remember what was said in Chapter IV about the use of paste and glue—and fasten it to the back of the book. It is needless to remind you that the back should ere this have been thoroughly cleaned of all old paste, glue, and leather. Brush paste into the slits of the boards from which the old leather was taken, and then insert the sides of the new leather, working them under the old leather left on the boards but lifted carefully by the knife or bone folder, as just mentioned a moment or so ago. Now turn in the top and bottom of the new leather, working them under the end leaves.

Rub all joints smooth with a folder, place wax boards or sheets of paper between the end leaves and the boards, put the book to press until it is thoroughly dry. If the paper along the inside joint has been torn

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or worn it may be necessary to paste a strip of similar stock along the joint, keeping the book open while these strips are drying.

Then carefully paste the old back to the new if it was removed without tearing, or match the pieces of the old leather back and paste them on in a way to make them match and give the original appearance. Rub them down and put the book to press for final drying. After it is taken out comes the time for inspection of new leather at the joints. If the shade matches nicely, well and good. If not, then comes a session with brush and pot of stain to make new and old live together in peace and quiet.

Interleaving. When it becomes necessary to bind odd and miscellaneous items such as documents, manuscripts, old newspapers, etc., interleaving them between sheets of uniform dimensions will be helpful and prevent much wear and tear on the material so protected. As a first step in this direction, measure the largest piece in the collection and cut sheets of durable all-rag paper two inches larger in height and three inches wider. These dimensions are not arbitrary and can be modified, increased or diminished as the particular case may warrant, but two inches height over the size of the material gives a leeway of three-quarters of an inch at top and one and one-quarter of an inch at bottom.

Now that we have the size of the interleaving sheet, the next thing is to cut strips of thin, strong

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paper, one and one-half inches wide, and the same height as the interleaving sheets. These strips become the stubs or hinges to which the material is attached. Each item should be pasted on the inner edge and tipped to a strip, taking care that the material is attached to the stubs at the same height, to make a uniform appearance. Treat in this way all the pieces to be handled and when dry, place them between the sheets previously cut, alternating a blank sheet and a hinged strip with attached item, thus interleaving the material. When this task is completed the sheets are jogged up to the back and are now ready for oversewing and binding.

This protection will undoubtedly lengthen the life of specimens so treated and will permit the book to be opened without danger of harm when it is laid flat for photographing or for exhibition.

Oversewing, it may be remarked—as distinguished from sewing by hand or machine through the folds of signatures—is a method, with several variations, of sewing single leaves of a book together, either by hand or machine.

Labels, paper and leather. Labels sometimes have their lettering marred or scratched off. They may be replaced by new ones after the remains of the old one have been carefully removed by means of a knife or scraper. New labels should be cut from paper or leather. Paper offers less difficulty than leather, as the leather must be washed with a size of thin paste to

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make it take the marking ink properly. Lettering should be put on the label and be perfectly dry before the label is pasted on the book. When it is safely dry and fast on the book it may be gone over with a protecting coat of thin varnish, lacquer, or shellac.

Restoration of book cloth. Stained or faded book cloth may be restored by application of a water color stain or size of proper tint. Make it by dissolving a tablespoon of white of egg in a cup of water. Allow twelve hours for complete absorption. To this add a tablespoon of paste, and enough color soluble in water to give the necessary shade. Strain it through a very fine sieve or thin gauze, and then apply with a small brush or soft sponge.

Water-soaked books. With books, water is an excellent servant but a most harmful and dangerous master. It is used at many stages of the manufacture of paper, and the stock retains its affinity for water through almost its entire life. When paper is made into books, water, however, is one of its greatest enemies. Warped covers, swollen and stained, pages wrinkled and creased mark the afterlife of the book exposed to water. Heavily-sized paper, coated with starch or glue or clay, is ruined by contact with water. The size, softened by the water, causes the pages to stick to one another, and if they dry in this state the book is a solid mass. Try to separate the pages, and the surface coating pulls off from the centre, destroying the print, and the only fate for the

volume is fireplace or waste pile. Books made of better paper will stand wetting with less serious damage, but their pages inevitably wrinkle and swell distressingly. This may be helped by dampening a few pages at a time with a moist sponge, smoothing down the wrinkles and creases, putting the pages between dry blotters, and allowing them to dry under pressure. Repeat with a few more pages till the whole volume has been treated.

If a book has been thoroughly soaked, it will probably be best to take it apart, smooth out the single leaves, drying them under pressure, collate and bind once more. When this must be done the paper will probably need resizing, as described on page 62. Paper in contact with water will nearly always be stained. Most of this staining will be removed in the sizing bath, but when sheets are not sized the stain may frequently be removed by judicious use of soap and water applied with a soft sponge. When doing work of this kind undamaged pages must be protected by wax boards and blotters.

Damage by fire. Books damaged by fire offer various problems. If the covers are charred and the boards intact, scrape off the char from the covers and paste a new outer cover over the boards. In some cases it may be best to take the old cloth off entirely and recase the volume. If edges are merely charred scrape them clean with a steel scraper and then use sandpaper to get a smooth surface. Gilding or mar-

bling will probably remove all traces of the accident. When scraping the edges put the book in a press or vise. If the margins permit trimming take the book out of the cover, trim top and bottom and fore edges with hand or power cutter, and then recase it.

If the text has been damaged and it is worth the expense the charred edges may be trimmed off to uniform size and each leaf be inlaid, the whole then being sewed and rebound. Or it may seem best to remove the char, fill in damaged spots with fresh paper, mount each page between silk or tissue paper sheets and then rebind. If damage has been limited to but a few pages, take them from the book, repair, insert on stubs left for the purpose.

When fire has made the paper so brittle that handling becomes difficult the sheet may be sprayed with a solution of gelatine size. The size should be hot, driven through a hand or power sprayer, and may be made according to the instructions set forth on page 62. This will give a coating to the surface of the paper, holding the brittle fibres together. Sheets so treated should be covered with silk or tissue paper.

Ink removal. The best ink remover is frequently a sharp steel eraser wielded by a skillful and competent hand. If the ink has penetrated too deeply into the paper for removal by this means try the commercial ink eradicators obtainable at any stationery dealer's. They are usually two liquids, one an acid and the other chloride of lime. The latter added to

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the acid gives off free chlorine which bleaches the chemicals in the ink.

India ink yields to none of the chemical removers. If the steel eraser can not scrape it away better give a sigh and cover the spot by a sheet of paper pasted over it.

White ink removal. White lettering ink is soluble in water. It is used for lettering dark colored surfaces. Libraries sometimes use it for indicating class marks, call numbers, authors, various other things on the back of books, sometimes protecting the entry by a coat of varnish or shellac. Alcohol will remove the varnish, and water can then be applied to the ink. This is all well enough for removal of the ink, but with the ordinary book cloths alcohol and water soften the filler of the cloth and start the colors to running. If there is danger of this better try the steel eraser.

Pitch, tar, and wax stains. Mutilation or disfigurement by pitch or tar is fortunately not frequent in books. It does happen now and then, and the steel eraser is the first resort. After as much has been removed by this means as possible, try turpentine for the next step. Be careful to see that the tar does not dissolve out of hand when the turpentine is applied, and spread to do more damage. After the tar has been thoroughly softened by the turpentine and the page seems clear wash the sheet carefully with benzene. Wax should likewise be first scraped with the steel

eraser. Then wash it with benzene, applied with a swab of cotton wool. This does not apply to sealing wax, which is proof against every chemical that will not harm the paper. The steel eraser or scraper is the only hope in such a case.

Solander or slip covers. Every now and then a book calls for treatment on account of its binding or cover. Sometimes a pamphlet must be cared for without binding, or the owner may wish to keep the unsullied sheets just as they came from the press or folder. For the first type a case or cover of some kind must be made; for the second there is a bit more variety of choice. A solander case gives best protection for binding. This takes its name from the eighteenth-century Swedish botanist who became keeper of the Natural History Department in the British Museum and developed this form of protection. The solander case furnishes complete covering for the volume, stands upright on the shelves, is divided into two parts, the lower one with a neck over which the upper one fits. The cover should fit the book rather snugly, and the leather should be about the same in quality and color and finish as that of the volume to be protected. This is one of the most expensive cases to make, and likewise is one of the most satisfactory so far as protection is concerned.

There are many other forms of slip covers, cases, boxes, jackets, wrappers, all to be made out of paper, cloth, or leather, and all of cost and amount of pro-

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tection afforded rises as the choice rises from the first to the third. Satisfactory making of a cover of this kind is a pretty test of the skill and judgment of a binder. The amateur can give himself much amusement and instruction by trying to make covers out of binder's boards, using paper or cloth for decorative finish.

Sometimes the binder is confronted with a book printed on paper of such poor quality as to defy sewing or any other form of binding, yet of such importance as to call for preservation. In such cases life may be lengthened, if not assured of immortality, by making a box, with hinged or slip cover or sides, of fitting size to hold the volume and to permit its standing upright with no further harm. This box may be covered with paper, cloth, or leather, the selection of material naturally being dependent on the binding of related volumes or the value and importance of the material thus protected.

Supply houses. The various materials mentioned herein may be purchased from library supply and bookbinding supply houses. Paper, small cutlery, paste may probably be carried by the local stationer. Chemicals and oils can be got from or through the local chemist or druggist. For retail buying of book repair kits, binder's cloth, paste, glue, and general mending supplies, the following firms may be kept in mind:

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Demco Library Supply Company, Madison, Wisconsin

Gane Brothers, 333 Hudson Street, New York 13,
New York

Gaylord Brothers, Syracuse, New York

H. R. Hunting Company, Springfield, Massachusetts

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TREATMENT of the paper stock. Treatment of the paper stock is usually the first requirement in the repair or reconditioning of manuscripts or old books. Sometimes, to be sure, it may be the binding or cover, the ink, or the pigment in illumination or decoration that needs attention, but the chances are in favor of the paper's requiring aid and treatment first of all. If the paper is unbound and in form of loose leaves the methods of treatment and handling will be practically the same as in Chapter IV except that more patience, skill, care and attention must be given. If the paper has to be handled in shape of a few leaves in a bound volume needing repair or mending a skilled workman may be able to handle them without rebinding the volume completely, but there is no doubt that better work can be done if the book can be taken out of its covers and if the sheets can be handled flat.

Paper for mending. With the risk of the charge of repetition fully in mind let it be said that the same general principles govern here as in Chapter IV. Mending paper should be of the same grade, thickness, and texture as the page to be repaired, or as near as is possible. Any binder with a plant of any age will usually have stored away a quantity of loose sheets of old paper of all sorts, held for just such uses as this.

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Thickness, weight, texture come first as specifications to be met. They are less simple to change than color and tint. With the first three granted or assured it usually is fairly simple to meet the problem of color or tint.

Darkening may be secured in various ways, but bleaching is not so simple. With a solution of tea or coffee an experienced workman can darken a sheet to almost any tint demanded. If you watch him at work you will notice he first tries a sample bit or full sheet and gets it thoroughly dry before he steeps the working sheet. It is dangerous to accept a solution unless one has tested it under working conditions and is sure of the result, whether a solution of tea or a solution of a problem.

Ethics of repair work. Just when it is right to repair a tear or make a restoration so completely as to show no signs of repair or restoration is a question of ethics that must be settled with each individual case. There is no general rule governing all instances. If the end and aim are deception, then the effort is indefensible. If it is merely an effort to return the page or sheet as nearly to its original condition as possible, then the effort is commendable. It all depends on the aim in view. Some collectors and booklovers insist on the repair work and restoration being performed in a way to render the page perfect but to show in plain and honest fashion just what had been done. Repair is honest, deceit is not.

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Filling holes in paper. Several varieties of tissue paper are suitable for mending torn pages. Pages with large tears, holes, missing parts may require extensive patching. Worm holes, similar perforations from any other cause may be filled in by means of a paste filler made of paper pulp or paper fluff and paste. This pulp or fluff may be got by scraping a sheet of the same paper stock with a sharp knife, scraping fluff from blotting paper, reducing paper to pulp by boiling. Add the paste to the pulp, and stain the mixture to match the stock to be repaired. Spread the original sheet out on a piece of plate glass, dampen it and fill the holes with the pulp, applying it with the blade of a small knife, smoothing it with a bone folder or similar instrument, placing it between wax boards for drying.

Cleaning paper. When it comes to a question of cleaning paper remember that the first qualifications are good common sense added to a knowledge of paper stock. Before beginning to clean paper stock a prudent workman will make a careful study to see how strong it is and how successfully it will probably withstand the rigors of cleaning. It's a really wise man who knows when to let well enough alone. Even a soft eraser may be too much for some weak fibred and brittle stocks.

Rubber erasers. If the paper is reasonably strong several methods of cleaning lie open to choice, de-

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pending largely on the nature of the spots to be removed. Surface dirt, pencil and finger marks, soil that has stained the surface but not penetrated deep, will frequently yield to a soft rubber eraser, a sponge rubber, a piece of art gum, even a small lump of clean dough.

Solvents. Benzene, benzole, gasoline are helpful in removing oil and grease stains. Saturate the spot with one of these solvents, place the sheet between blotters, and go over it with a hot iron, hot enough to remove the stain and solvent but not hot enough to burn. If the stain is old and the saturation heavy it may be well to soak the spot thoroughly in kerosene for several hours before using the benzene, benzole, or gasoline.

Alcohol is excellent for removing iodine, mold, mildew stains.

Warning. All these solvents are harmless to paper stock. But they may dissolve not only the stains but the printing ink, causing it to run and give another and unexpected stain. A word of needless warning also cautions against using any of them near an open flame. Their fumes may be ignited several yards away from the flame. After using them open the windows and change the air.

Washing of paper. Good rag papers may be washed in a bath of soapy water, or may be cleaned by sponging them with a soap jelly, then removing the soap with a clean damp sponge. Take care to see that the

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soap is pure, free from scent or coloring materials, a good castile soap being safe.

A few spots in a bound volume may be treated here and there, but if there are many it is better to take the book out of its binding. Recasing may call for more care and attention, but the result will probably be better if the sheets can be handled freely and be put to press by themselves, leaving those that need no treatment to rest in peace.

Coated paper, highly glazed, should never be touched by water, which will certainly dissolve the surface and ruin the paper beyond possibility of repair.

Sizing of paper. Most papers, except blotting paper and soft, high bulking book stock, are sized. Sometimes sizing is done in the beater before the paper is made, but in the better grade papers sizing is done after the sheet has taken shape. Size is any gelatinous substance, such as casein or starch or glue, that is added to the paper stock to glaze the surface, binding the fibres together, improving the surface, adding to the strength. With book and writing papers it is usually a good quality animal glue. Put a sheet of paper in a bath of water, or treat it with chemicals to wash or bleach it, and you will find that removing the stain or discoloration or dirt has likewise removed the original sizing material. The sheet is limp and soft, useless for its original purpose.

Resizing. But, resizing will restore it. This, how-

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ever, should be the last step in the process of restoration. All other things must have been cared for, nothing more to be done but returning the surface to its original condition. To make the size take one ounce of the best gelatine or one ounce of isinglass, and dissolve it in 32 ounces of water. Mild heating of the water will hasten the process. Reducing the amount of water will make the size stronger, but the heat should be applied gradually to prevent danger of burning the liquid and turning it brown.

If luck or skill has been with you there will be a clear liquid in the container. Strain this through a clean cloth into a shallow pan large enough to hold the sheets of paper about to be treated. Best results will follow if this shallow pan can rest above a gas flame or some other form of heat to keep its contents at about 125 degrees Fahrenheit.

And now comes the time for immersing the paper. But be sure to look at it carefully once more, to be sure it calls for no further attention, to be sure all dirt and pencil marks and finger prints have been removed. If not, sizing merely means fixing them. Some stains, however, will be removed in the warm bath, especially brown water stains.

Carefully put the sheet in the size bath, and then take it out, not too slowly, not too hastily. Put the sheets on top of one another, and when the whole book has been treated the pile of sheets should then be placed between backing boards and be put in a

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backing press to have the surplus liquid squeezed out into the pan placed below to catch the drip.

Then spread the sheets out on large, clean sheets of paper, to dry. It means that care must be taken to prevent the sheets sticking together while in the press or while laid out to dry. With proper equipment it may be best to clip each sheet to a line and let it dry by hanging in the air at a convenient height. In either case dust and dirt must be kept from them. After drying they must be run through a mangle or press, then folded, and made ready for binding. If there are only a few sheets for treatment it may be sufficient to lay them between sheets of clean blotting paper, then ironing or pressing them when dry. But in all cases be sure they are quite dry before taking the next step.

Foxing. Not infrequently on old paper, less commonly on modern stocks, one finds a dull rusty patch discoloring the page in annoying fashion. This is due to "foxing," the term going back to the rusty red of Reynard the Fox.

The latest and fullest discussion of the problem of foxing is found in the paper read before the College and Reference Section of the American Library Association at the conference at Denver in 1935, in June, in a paper by Thomas M. Iiams and T. D. Beckwith, "Notes on the causes and prevention of foxing in books," printed in *Library Quarterly*, October, 1935.

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Foxing is due, the authors find, to growth of fungi. The foxed areas are more acid than the unfoxed or clean parts. Paper-infesting fungi can produce acid in a medium in which cellulose is the sole source of carbon for this acid by-product. Starch sizing increases acid, casein decreases it, rosin seems to inhibit both the growth of fungi and the production of acid.

Iron in paper—a result of chemical impurities unremoved during process of manufacture—stimulates the growth of fungi, which in turn is responsible for the development of by-products rich in insoluble iron salts that are not only injurious to paper fibre but are productive of the characteristic "fox" color as well. These reactions are to a certain extent dependent on the amount of moisture present.

Paper weakened by improper methods of manufacture, by excessive variations in moisture, by unintelligent use tends to be favorable to growth of foxing. Storage of books in steel stacks in fairly well-ventilated rooms, where the moisture content of the air does not exceed 75% of saturation, helps much to reduce foxing.

Use of bleaching agents "may tend to impair the already none-too-stable paper, and should be restricted to extreme cases, and then applied only by experts. We have still to find a method of removing foxing from books that is at once efficient and yet shows promise of producing no deleterious effects

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in years to come on the paper treated." It is to be hoped that iron-free paper may be made with an inhibitory substance in the sizing that would be resistant to foxing, under proper storage conditions.

So far as we know today there is no way of stopping this foxing once it has begun. The first blame rests on the iron in the paper. The foxing runs with the particular paper stock. There is little, if any, danger of its spreading from one book to another, unless the paper came from the same run of paper.

Bleaching. Bleaching of paper for removal of foxing and other stains may be done by several chemicals, all with the advantages and disadvantages of such treatment. The fly in the ointment appears in shape of the warning that many chemicals remove spots and also weaken the paper. Bleaching is perfectly possible, but it is recommended only when it will not do more harm than good.

Bleaching by potassium. Excellent results for bleaching may be secured by the use of potassium permanganate and potassium metabisulphite, when in the hands of competent and intelligent workmen. Three shallow trays are needed, one filled with permanganate, the second with water, the third with the metabisulphite, each of the potassium compounds diluted to the strength of one ounce to sixteen ounces of water. Use glass or rubber trays, never metal. Put the paper in the permanganate solution for a short time, say thirty to sixty seconds. The sheet will turn a

deep, purplish brown in this staining solution. Lay it next in the clear water and wash off the permanganate. Then comes the turn of the potassium metabisulphite, and in it the sheet will turn white almost instantly. Leave it in this pan until all the stains and spots disappear, and then put it into running water to wash till all traces of the chemicals have been completely removed. Let it dry between blotters, and then put it to press to remove wrinkles.

Other bleaches. Now and then a stain will greet the workman with refusal to disappear in the metabisulphite solution. In such a case wash off the metabisulphite with clear water, put the sheet in a pan containing a solution of potassium ferricyanide of the same 1:16 strength. If it does not disappear quickly the case is almost hopeless. But another attack may be made with a hydrochloric acid solution of the same strength, after having washed off the previous chemicals. If the spot still persists it may be written down as practically removal proof.

Toning down to neutral shade. This bleaching leaves the paper snow white, and if the sheet is to be toned down to what is called a neutral shade it may be darkened at will by soaking once more, this time in a water bath colored by a solution of tea or coffee or a brown aniline dye. This stain may also be mixed with the sizing liquid. Prudence and forethought suggest that it may be well to test the strength beforehand by dipping and drying a small test sheet as a

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sample to make sure the right shade has been secured.

Other formulæ. Permanganate is, to be sure, not the only treatment. Many other formulæ may be brought forward, some with a record of success and some with less fortunate histories. Oxalic acid, javelle water (chlorinated potash), ammonia, hydrogen peroxide, sulphite of soda, bicarbonate of soda, and other solutions and combinations all have their advocates. All offer promising opportunities for the workman with a bent toward experimenting.

Hydrogen peroxide. With hydrogen peroxide it is best to take a shallow pan and fill it with liquid plaster of Paris. When this sets and hardens saturate the slab of plaster with hydrogen peroxide, and lay on it for several hours the print to be treated, face down. If the spots disappear the sheet must then be washed, dried, pressed. If the spots refuse to budge perhaps a stronger solution may have better luck; perhaps a mixture of peroxide and ammonia or alcohol may succeed. These combinations seem less reliable than the potassium treatment, but there is no certainty that the various results may not be due more to varying skill of the workman than to the chemicals themselves. Perhaps it is a matter of opinion, perhaps not.

Acids and alkalis. When hydrochloric acid is used the acid must be poured into the water, not the water into the liquid. If the latter is done there is danger that the liquid may splutter and splash out of the container. When an acid is used for the bleach the

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paper should have an alkali bath as a neutralizer. After javelle water the paper should be washed in a solution of sulphate of soda. If hydrochloric acid is used the afterwash should be bicarbonate of soda.

This is all well enough as a statement of ideal, but there is danger of failure unless one brings to the effort satisfactory training in chemistry. The solutions must be perfectly balanced to insure this neutralization, and in this as in other things success is largely a result of ceaseless striving. Be prepared to make many experiments with paper of no value before trying to bleach important documents.

Warnings. With single sheets in a book it may be best to cut them out, bleach, wash, tint, and remount them on a stub left for the purpose. In such cases it is of course perfectly obvious what has happened, and there is of course also the danger of failing to secure an even tint as compared with the rest of the volume. To insure uniformity, and to work more expeditiously if there are many sheets calling for treatment, it may be most convenient to take the whole volume out of the covers, treat all sheets, wash, dry, press, resew, recover.

Dangers of weakening. Bear in mind also that this attack by chemicals, this washing and rewashing, this bleaching and tinting may be safe with paper of undoubted strength, but it is weakening even for the best, and certainly is dangerous for stocks with fibres affected by attacks of one kind or another. The

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experienced eye will decide not infrequently that it will be more satisfactory to accept the sheet with the stain and with a known and certain strength rather than to succeed in removing the stain and at the same time secure dangerous weakening of the fibres. Occasionally decay has gone so far that covering with silk or tissue paper offers the only hope of preservation even with the stain left in all its rawness.

Treatment of color prints. Remember too that treatment of black and white prints (whether done by ordinary typography or by engraving or etching processes) is one thing and treatment of colored prints decidedly another. Color prints made with ordinary fast colors, aquatints, modern offset color prints, and all ordinary black letter prints and engravings may be treated with potassium permanganate and potassium metabisulphite with every hope of success if the work is done with ordinary care and attention. Such prints may be cleaned and brightened, may have all traces of stains removed from the paper without damage to the color.

Danger, however, lies in the face of the man trying to treat in this way paper bearing water colors, or sheets printed with ink of fugitive colors, or sheets with highly coated surfaces. The water colors will run, the fugitive colored inks will disappear or bleach, and the starch and clay and size of the highly coated surfaces will soften and stick together or the

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surface coating will wash off completely as soon as the sheet is given its water bath.

Even with black-and-white prints a knowledge of ink and color is advisable. Bleaching tends to weaken ink and color and paper stock. Modern carbon black inks are acid proof, to be sure, but even with them there is constant and insistent call for attention and alertness. An open mind and a willingness to experiment will well repay all efforts they demand.

In case of doubt or question it surely is simple to find a piece of paper similar to if not identical with the one in question, and test and try it before giving the primary sheet its irrevocable plunge.

Restoring lettering. Sometimes the printed page suffers an accident that dims the text by rubbing, chemical action, or various other causes. Restoration is not impossible for the steady hand guided by an experienced eye. The obvious means is a bottle of India ink and a draftsman's pen.

Printing types may also be used. For this latter process select a face as near the original as possible. Spread a bit of printer's ink on a sheet of glass or other smooth surface, by means of a brayer or printer's hand inking roller. Dampen the paper slightly. Ink the type by means of the brayer, getting it on not too much nor too little. Then press the type down on the paper. Two or three "warming up" exercises on specimens where mistakes are not vital will help insure success on the important sheet where an error is

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unforgivable. Be sure, however, to experiment with a sheet of the same general character as the original stock.

Restoration of rubricated letters. Restoration of faded rubricated initials is possible by means of ink of proper shade and material. In general a good oil paint applied by a fine camel's hair brush will give satisfaction. The treated page should dry thoroughly before being handled. Rubrication or illumination done by oil paint or by printer's ink necessarily calls for oil color or printer's ink restoration; where the decoration is in wash or water colors restoration must be in the same medium. It is surely needless to sound a warning against letting any one but an artist and workman of unquestioned ability undertake a task of this kind.

Vellum and parchment. Parchment and vellum present decided difficulties in handling. Made from the skin of calves or sheep they change almost as rapidly and widely as the thermometer. That statement is exaggerated, as a matter of fact, but there is no doubt about the trouble they make while kept under modern conditions.

Preparation of skin for writing. Skin has been used for writing materials from an early date. It comes down to us usually in form of a volume or codex, sometimes also as the binding for such a volume, more rarely in the primitive form of a roll. The skin was limed, shaved, washed, stretched, scraped,

rubbed smooth with pumice stone, and then turned over to the scribe. Skins from still-born calves were usually selected for the finer sheets. Those from the older animals were usually so tough they could be put to better use as bindings than as sheets for the written message.

Vellum in any form is affected by heat and moisture more than paper. It is inclined to stretch, shrink, wrinkle, cockle, warp as the surrounding air grows more or less moist or humid. This explains the straps or thongs or clasps found so frequently on old parchment bindings. But even such fastenings fail to keep the cover flat and straight, and for shelving under modern conditions better results will follow the use of a slip case than thongs or clasps. The case should be tight enough to keep the volume under constant pressure, loose enough to permit the book to be put into it or taken out without harm.

Bleaching vellum. Old vellum is frequently yellow or cream in tint, sometimes just cream enough to be altogether attractive, but not infrequently so near brown as to render the writing difficult to read. It may be bleached, but bleaching should be chosen only as a last resort, the burden of recommendation for such action being serious and demanding unquestionable justification. The danger of making the ink run is something to be borne in mind, for most specimens calling for attention will probably be manuscripts done with writing inks rather than printed

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pages, and some writing inks are less permanent than most printing inks.

Cleaning vellum. Far better to try first to clean the sheet by sponging with a lather made from a good soap, free from acid or alkali, the lather made with as little water as possible. After sponging carefully wipe it dry, put blotting paper on each side, place it in press or under weights until thoroughly dry. A soft rubber eraser, alcohol, benzene are other cleansing means to fall back on as need arises.

Smoothing wrinkled vellum. When it comes to straightening vellum leaves that have bent or twisted or cockled the first thing to do is to moisten them, but real care must be taken to see that water does not come in direct contact with the sheet. This is particularly important in the case of illuminated manuscripts. Water may be applied directly, to be sure, but there is danger then of starting the ink to run or danger of removing it. A safer way is to apply this moisture by means of a humidifier or a box made in a way to hold moistening pans or to permit safe introduction of steam.

Treatment of palimpsest manuscripts to bring out the original writings belongs to the paleographer and archivist rather than the bookbinder, and lies out of the scope of this volume.

Straightening single sheets of vellum. If the book can be taken apart the problem is simpler than if it must be met by treating the bound volume. With single

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sheets it is simple to make a frame of wood, slightly larger than the sheets to be treated. Then attach clips to the sheet, with strings attached to weights. The sheet can be so adjusted that there will be an even pull in all directions, and the moisture will permit it to be flattened evenly. Be sure it is completely dry before removing the clips and strings. The drying should be gradual, and sometimes it may be well to apply artificial heat if the heat can be kept well under control. Haste will do more damage than good here. Remember that parchment came originally from the East, and remember the word of advice about trying to hurry the East. It holds good here without question.

Sometimes vellum may be softened by application of steam, but live steam must never come in contact with the skin.

Be sure the sheet is perfectly dry when taken from the press. Otherwise you have the work to do over again, for warping and cockling are almost inevitable unless the drying was complete.

Oil for vellum. After the vellum has been washed with soap and water it will naturally be somewhat softer, and before it becomes brittle and hard again it should be given two or three applications of neat's foot oil and lanolin, rubbed well into the skin. This will keep the skin in good condition and help render it less affected by moisture or dryness in the air.

Warped vellum covers. Pasting an extra sheet of

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paper inside each cover often helps correct badly warped vellum covers. This tends to draw the covers inward, and to keep the boards flat by counteracting the outward pull of the vellum.

Boards. Wooden boards were first used in early books. When replacement of such boards becomes necessary, it is obvious the same type of wood should be selected, if possible, that it be dry and thoroughly seasoned to prevent warping.

After the invention of printing from movable types, wooden boards were supplanted by paper boards made from sheets of printers' waste pasted together. Later on the increased demand brought about the manufacture of binders board made from old rags, rope and waste paper. Boards have been made for special and selected books from many materials, such as plywood, bakelite, metals, fibre and plastics. All these have had one drawback or another, none of them proving as satisfactory as a good quality, solid binders board.

Other leather manuscripts. Manuscripts on leather that is decidedly neither vellum nor parchment sometimes come to attention in shape of drawings on skins made by American Indians or other primitive people. They need about the same kind of treatment as other skins, moistening to flatten under pressure, application of neat's foot oil and lanolin to keep soft and pliable, sewing tears to prevent further running, or patching with fresh skins to fill holes or straighten

edges. Skins as nearly the color and texture of the original should be chosen, to make an obvious remark, the edges shaved as the piece is cut to the size of the hole to be filled, binding done by means of any good leather cement.

Need for care of this kind will come so seldom to the average librarian or collector or binder that attention to individual cases may well be left to advice of specialists when need arises. But, to repeat once more, the same general principles governing attention to vellum and parchment and leather bindings will govern here.

Papyrus. Papyrus is the name applied to the writing material used by the ancient Egyptians, the Greeks, and the Romans. It was prepared by cutting longitudinal strips of fibres from the papyrus plant, laying them across one another in two layers, soaking them in water, and pressing them into a smooth, even surface. There was enough natural glutinous matter in the fibres to cause them to adhere closely when pressed or beaten dry; some people credited this adhesion to the peculiar qualities of the water of the Nile. After they came from the press they were smoothed with pumice stone or some other abrasive.

The ink used on them was probably made from water, glue, lamp black or carbon. This must constantly be borne in mind, as there is danger of seeing the ink run if the sheet is carelessly soaked in water.

Papyrus sheets. Papyrus sheets come in various sizes

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and in all sorts of conditions. According to Pliny "There is a great difference in breadth of the various kinds of paper. That of the best quality is thirteen fingers wide, while the hieratic is two fingers less. The Fanniana is ten fingers wide, and that known as 'amphiatheatrica' one less. The Saitis is of still smaller breadth, indeed it is not so wide as the mallet with which the paper is beaten; and the emporetica is particularly narrow, being not more than six fingers in breadth." (Natural History, book 13, chapter 24.)

They were usually made into rolls about twenty or thirty feet long, but sometimes were used as single sheets about the size of one's palm. They come to us today in both forms, and to meet modern conditions the rolls should be cut into convenient sections and these sections, as well as single isolated sheets, should be protected by glass.

Straightening papyrus sheets. Many of these sheets are sadly wrinkled and creased, brittle and dry, breaking at the slightest attempt to flex or bend or fold. The first requirements for straightening them and putting them into condition for reading are trained hands, intelligent eyes, common sense, an alert mind. To these immaterial things may be added such equipment as a sheet of plate glass, some sponges, a water bowl, some small brushes, blotters, flat-bladed knives, and at least one knife with a pointed blade.

First see that the sheet of glass is clean, absolutely clean. Then wash it off with benzene. This will leave

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a slight film of oil on the glass, preventing adhesion. Then dampen it with a sponge and water. Spread a piece of fine gauze smoothly over the glass. Put the papyrus on the gauze and wet it with sponge and water until it becomes soft and flexible. Flatten out the wrinkles by stretching and pressing. The point of knife or a small brush may help rearrangement of fibres formerly fixed discouragingly out of place. Turning back portions folded over may occasionally bring the thrill of revealing part of the text hitherto hidden and unknown.

More water will bring out dried mud and dirt, but this water must be removed quickly by soaking it up with the sponge. When the necessary folding and flattening and smoothing have been finished, blot off the surplus water, and lift the sheet off the glass by means of the silk gauze, which will thus support the papyrus and make removal more safe and easy than without it.

Put the papyrus face down on a blotter and strip of the gauze. Let it dry partially and then put it to press. If pressed while it is too wet there is danger of blotting off the ink. If it gets too dry before pressing it will wrinkle and cockle again.

When both sides of the sheet bear writing two glasses may be used, both prepared in the same manner with benzene and gauze. Finish the first side of the papyrus sheet, strip the sheet off the glass, lay it face down on the second sheet of gauze and glass.

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After it has been treated, washed, flattened, finished, strip it and place it on a blotter for drying.

When dry the sheet should be perfectly flat, but it will not stay flat unless it is protected, something best secured by laying it between two sheets of glass and binding them by a tape passe partout or a wooden frame. If there is no writing on the back, or no other objection, it may be well to mount the papyrus on a good quality of picture mount board and frame it under glass. Sometimes it may call for covering with silk before putting under the glass.

In all this it is experience and common sense that insure success much more than any formal set of rules to govern details of method and procedure. A binder competent to do work of this kind will succeed if he is grounded in the fundamental principles of his work and supplements them by an alert mind and an active interest in accomplishing the unusual, no matter whether he has been given rules or not. No need to tell him to try his first ideas on pieces that do not count, rather than begin with an attack on papyrus of first importance.

Oriental manuscripts. Manuscripts from the farther East, China, Japan, and India appear on paper, palm leaves, and occasionally on leather. Treatment of the paper stock is governed by the same principles controlling paper made in the western world; earlier specimens are all hand made and are usually better than the machine made samples of more recent years.

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Technique of handling them differs only as the surface and foundation stock differs from more common paper. So too with writing on leather. Leather is leather, and its care and treatment are the same whether it was tanned or prepared east of the 180th meridian or west of it.

Palm leaf manuscripts. Manuscripts on palm leaves demand treatment rather infrequently. When holes in them must be filled the task is more for the cabinet maker skilled in veneer work than for the ordinary binder. So too manuscripts from the Pacific Islands call for such special attention as to insist on treatment and care by workmen of such skill and experience as to need no help from a book like this. Each case must be handled as its demands are studied. Holes must be filled by something as nearly like the original as possible. Tears must be controlled by some safe adhesive. Protection must be assured by restoring the covering wrapper, by making a new frame, by taking such steps as the case seems to call for. If the workman is intelligent and skilled and honest he will know how far his previous experience will carry him, and likewise will know at what stage he must call for help and advice. If he is not of this type the work should not be put into his hands.

The Care of Leather Bindings

LEATHER as binding material. Of all bookbinding materials leather comes nearest to being ideal. It is pliable, can be worked to advantage by both forwarder and finisher, takes tooling and gold admirably, is good to look upon, is delightful to handle. Till recently it was the most lasting material known for this purpose and was always specified when books were to be bound in the best manner possible.

Modern tanning. The tanner, however, yielded to the insistent cry of the customer for more speedy delivery, renounced time honored traditional methods, rushed the hides through the vats, and handed the binder a skin inferior in every way—save quickness of tanning—to those produced with less haste. The last fifty years have seen the worst of this practice, and it is safe to say that few books bound with leather tanned during this period now have their leather in good condition, at least in this country. Many recently tanned skins show deterioration within five to ten years, and few tanned within the last half century can compare with older leather. Now and then by careful shopping one may find well-tanned skins, acid free and certain of long service, but tanners with pride enough in their calling to turn out skins warranted to last do not stand on every corner.

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Acids in tanning. It is the introduction of sulphuric and other acids into tanning processes that must bear much of the blame for this state of affairs. Decay is helped also by the infusion of acids and other bleaching agents used to produce even shades of color.

Chrome tanning. A faint ray of hope is suggested by the belief that some competent judges trust chrome-tanned leather may prove as lasting as that turned out by old-fashioned vegetable tanning; little more can be said, however, than that hopes are encouraging but lack of complete confirmation.

Gas charged air. It is scarcely fair, however, to lay all the blame on the tanner. He certainly has much to answer for, but he might very properly ask if the most unmitigated optimist could expect well-tanned skins to overcome the gas-charged atmosphere of our modern cities. There is no doubt that the high sulphuric acid content of the typical industrial city has much responsibility for decay of leather bindings. If the skin is subjected to dampness the danger of mildew is always present. Direct sunlight is harmful also, as is storage in rooms too warm and dry. The binder can not escape unscathed if he wet the leather too much or stretched it too much when covering his boards, or if the finisher used oxalic acid or vinegar.

Air conditioning. Book owners and librarians may mitigate some of these harmful effects if they do not remove them entirely, by control of ventilation and humidity. Clean fresh air, not too hot, not too moist,

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not too dry, should be given constantly. Books on the upper shelves should be watched particularly, for they usually suffer most from excessive dryness and from accumulation of harmful gases.

Leather dressings. Application of certain dressings will lessen the harmful effects of modern conditions on leather bindings. Some of these dressings are mentioned below. How often they should be applied will depend on circumstances. There is no general and universal rule of faith and practice, but a moderate amount of attention joined to a bit of common sense will soon show when leather begins to dry off, to crack at the edges or corners or hinges. Of course the remedy should be applied before necessity arises, but it is given to few of us to be foresighted enough to anticipate trouble of this kind. In general it may be safe to suggest once a year or thereabouts for the ordinary collection in the modern building in the average American city. When conditions change to extreme north or south, to very damp or very dry places, to high altitudes, to the tropics, or to other unusual situations the needs become so far removed from the average as to call for special attention.

Here are formulæ for several dressings all of which have been proven helpful for leather:

Lanolin and oil dressing. Take four parts of lanolin of about the consistency of lard, and warm it slowly until it becomes fluid or free running. To this add six parts of neat's foot oil (pure, filtered, wholly neu-

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tral), mixing the two thoroughly. When cool, apply the mixture with a flat varnish brush of proper size, or a soft cloth or pad. Let the books stand for a few hours or overnight until the oil is absorbed. When dry, rub with a soft cloth. If more polish is required apply a small quantity of castor oil with a soft cloth or pad, and when it is dry rub with a chamois or sheep's wool polisher.

Take care to keep the oil away from the paper of the book or from cloth to be used in binding. Experienced workers frequently hold the book in the left hand and apply oil and cloths with the right. It is certainly needless to remark that large volumes should be placed firmly on the table and should receive particular attention to see that no unexpected mishap marks the treatment.

Newly bound books may be treated on receipt, with a second treatment six months later, and a third in about a year if conditions seem normal and average.

Lanolin is prepared from sheep's wool. It is light yellow in color and it absorbs water readily. It is used generally as a base for ointments and cosmetics, and does not become rancid. Neat's foot oil is extracted from the feet, bones, and hide of neat cattle. It is pale yellow in color, consists mostly of olein, and is used as a fine lubricant and as a leather dressing. Castor oil comes from the seed of castor oil beans. When fresh

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it is inodorous, but it becomes rancid on exposure to the air.

In 1926 the Bureau of Chemistry of the United States Department of Agriculture suggested the following composition (all parts by weight):

Castile soap	3 per cent.
Neat's foot oil, 20 degree, cold test, pure	25 per cent.
Tallow	10 per cent.
Turpentine, pure gum	12 per cent.
Water, distilled, or clean rain water	50 per cent.

Dissolve the soap in the water by heating on a steam bath or in a double boiler. Melt the tallow in the neat's foot oil by heating in the same way. While both solutions are hot pour the soap solution in a thin stream into the tallow and oil mixture, stirring thoroughly until a homogeneous milky-white emulsion results. After this cools to room temperature add the turpentine and stir until thoroughly mixed. Keep in a well-stoppered bottle or can. Shake before using, and apply in the same way as the oil dressing.

Here are five formulæ developed by the late Dr. Fletcher P. Veitch, principal chemist in charge of the Industrial Foreign Products Division of the Department of Agriculture at Washington, associated with Mr. R. W. Frey of the same Department, in reply to a request from the Library of Congress in 1929:

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Number 1:	per cent.
Lanolin, anhydrous, U.S.P.	50
Japan wax	20
Sodium stearate	5
Sperm oil	25
Number 2:	
Lanolin, anhydrous, U.S.P.	50
Japan wax	5
Castor oil, U.S.P.	40
Sodium stearate	5
Number 3:	
Lanolin, anhydrous, U.S.P.	50
Japan wax	10
Neat's foot oil, 20 degree cold test, pure	35
Sodium stearate	5
Number 4:	
Lanolin, anhydrous, U.S.P.	30
Japan wax	5
Castor oil, U.S.P.	12
Sodium stearate	3
Water, distilled	50
Number 5:	
Lanolin, anhydrous, U.S.P.	17.5
Japan wax	10.0
Neat's foot oil, 20 degree cold test, pure	25.0
Sodium stearate	2.5
Water, distilled	45.0

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Unless the leather is much worn any of the five may be used first as a cleanser and then as a dressing to follow. Treated books should be allowed to stand 24 hours after the dressing has been thoroughly worked into the leather.

Of the five the Library of Congress found the fourth best suited to its needs.

British Museum dressing. A formula developed for the British Museum stands as follows:

Lanolin, anhydrous	7 oz. (avoir.)
Beeswax	½ oz. "
Cedarwood oil	1 oz. (fluid)
Hexane	11 oz. "

Dissolve the wax in the hexane in a warm place, taking care to keep it away from naked lights, as hexane is volatile and easily inflammable. Add the cedarwood oil, and then lanolin, which should be previously softened by warming. The mixture must be thoroughly shaken before using.

"The chief reasons for combining these ingredients in this leather dressing may be briefly stated as follows. Lanolin is an animal fat which is very easily absorbed by leather and does not become rancid. At ordinary temperatures it is in the form of a thick grease, and to use it thus would be to get uneven results and unduly strain the leather binding. A little wax is added to assist in polishing and to provide a thin surface film which, in the treated binding, rein-

forces any powdery or cracked portions of the leather and provides a protective 'skin' of considerable importance, particularly in the case of vellum bindings. The cedarwood oil, in addition to its well-known qualities as a preservative, is of value in forming a bond of union between the lanolin and wax in the leather, and hexane is chosen as a convenient 'thinner' as it readily dissolves beeswax.

"The method of applying the mixture is as follows: First the bindings are washed in the usual manner and set out to dry in a warm room for two or three days, and then the leather dressing is well rubbed in. The leather will now feel greasy to the touch, but after standing for forty-eight hours it will be found that this lanolin has penetrated and the binding can be easily polished. This operation leaves on the surface a shiny 'skin' which shows the grain of the leather to the best advantage. It is not in any way a sticky or resinous surface after polishing, and the general effect of the treatment is to soften the leather and prevent it from drying up.

"This mixture forms a cheap and effective dressing for all kinds of leather and vellum." (British Museum Quarterly, January, 1928. v. 2, pp. 77-78.)

Oil of egg dressing. Oil of egg has also been used with success. It is obtained by extracting yolks with ether or chloroform, and is used also in preparation of ointments and emulsions, and in tempera painting. Leather is sometimes treated with "eggio," pre-

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pared from eggs preserved in the liquid state by adding salt and borax. (Thorpe's "Dictionary of Applied Chemistry," 1921, v. 2, p. 616.) When oil of egg is used it is subsequently followed by a dressing of beeswax to give a polish by rubbing vigorously with a soft cloth. Some libraries use a furniture polish put up in England, and at least one individual comes to mind who swears by his saddle dressing as equally good for his leather bindings. Neat's foot oil surely serves many purposes.

Secret preparations. From time to time other formulæ have been brought forward, and all deserve thoughtful consideration. Some are described as secret preparations, so carefully compounded as to urge the fortunate discoverer to keep the mystery sealed from curious or unsympathetic or unappreciative eyes. The temptation is strong to ask if you have sufficient ground for confidence that when the seer was granted insight into the mysteries assurance was also given that no harmful ingredient was thoughtlessly or inadvertently added. "Caveat emptor" holds good in many fields.

Some of these "secret" preparations have been analyzed and found to contain harmless ingredients, but priced much higher than the component parts could have been bought for in the open market. Of course the seller deserved remuneration for time and trouble in combining the materials, in selecting an attractive container, and in evolving an enticing

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name, but whether this cost was reasonable or excessive may be left as a matter of opinion. Common sense, however, asks why in heaven's name one should choose a "secret" formula when harmless and helpful ingredients, in covenants openly arrived at, lie freely at hand.

Mineral oil and leather. In all the formulæ set forth above all the oils and greases—with but one exception—are either animal or vegetable. Vaseline and other mineral oil compounds have their earnest advocates, but some of us believe that the less mineral oils are used on leather the better it is for the leather. Ask any machinist what effect mineral oil has on leather driving belts, and he will tell you that it causes the belt to crack and disintegrate, in direct contrast to the effect of animal or vegetable oils. Bookbinders will generally give the same testimony as to the relative effects of animal and vegetable oils as contrasted with mineral oils, so far as leather bindings are concerned. Lamb's "Leather Dressing" (3d edition, 1925, p. 256) says "Mineral oils are advantageous when used for lubricating purposes; they are useful in currying and for oiling-off of various leathers; they, however, do not feed and lubricate the fibres of leather as effectually as animal or vegetable oils."

Acid effects on leather. Some years ago the binders in The New York Public Library realized how conflicting were the pieces of information and advice

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they were able to secure as to treatment of leather, and they set out to experiment and observe for themselves. Every solution or preparation that came to attention or could be found by diligent search was tried, and careful notes were taken of the results. Samples for testing were taken from levant, morocco, pig skin, calf, cow, sheep, tanned in this country and in England, France, Germany. Swatches from designated parts of each hide were exposed to gas light and gas fumes in a chamber specially constructed for the purpose. Some were exposed to sunlight and to air under glass, and others to direct sunlight and unprotected city air. Some were treated with various preservatives and some were left untreated.

The experiments continued for many months, each particular exposure being at least 2,500 hours. At the end all the samples, treated and untreated, exposed and unexposed, were sent to the Bureau of Standards in Washington. Study and examination there showed that all skins treated with any preparation that came in the class of those mentioned with approval above were benefited, even specimens knowingly selected as acid tanned. Untreated skins deteriorated obviously, some showing practically complete disintegration. Treated specimens from the same skins gave strength tests at the end higher than in the beginning.

Five samples of one leather, a full chrome-tanned calf skin that was not a bookbinding leather, were

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included. These withstood the action of gas fumes markedly better than any other sample, which seems to indicate that the substitution of chrome for vegetable tanning may solve the problem of permanence for bookbinding leather. Absolute proof, however, waits for further and more exacting testings.

The general experiment showed conclusively that acid-tanned leather deteriorated when exposed to heat and to gas laden air, acid-free leather suffered less. Both kinds suffered when exposed to noxious gases, acid-free leathers showing greater resistance. Both kinds showed improvement when treated with preservatives. The test was scarcely long enough or comprehensive enough to demonstrate absolute superiority of one method of tanning as compared with all the others.

Treatment should be frequent. It needs no ghost come from heaven, however, to say that treatment of leather-bound books should begin when the leather is new, with its life and strength unimpaired. Treatment will help leather resist the constant attacks given by its environment. Treatment will not help leather when the stock is thoroughly dried out or infected with rot or red rust. There the case is hopeless. Somewhere between the two extremes appears the condition when treatment will effectually restore fading life, or the condition when decline has begun but the decay will be lessened by treatment.

The Treatment of Cloth Bindings

*COLOR*ED bindings. Color has of late swept the world of bookbindings just as emphatically as it has taken hold of the bathroom or the kitchen or any other part of the house. Not so long ago book coverings were uniform and sombre in that uniformity. Here and there a library would bind one class of books in cloth of one color and another in a different color, but in every case every book in the class was uniform and sedate. No jazz there. Within a few short years book covers, even book jackets, have yielded to this color advance. Publishers have vied with one another to find striking and attractive color effects, and the makers of binder's cloth have been as successful in selling these rainbow-hued products to the binders for repair work as for original edition work. And now the librarian may make choice of brilliant colors, pastel shades, embossed patterns, cloths with two-tone effects.

No doubt as to the bright and cheerful effects of the shelves of new books, and all is equally bright and cheerful in the heart of the librarian until the books have circulated a few times and have taken their toll of the grime on hands that fondled them and the dirt on tables that held them. If not worn enough to call for rebinding could they be cleaned or freshened up?

Color in artificial leather. If they were in artificial

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leather (usually cloth colored and surfaced to look like leather) or in the waterproofed buckrams the problem was simple. Dirt on such bindings responded readily to a cloth slightly moistened with nothing but water. Life is not so simple, however, and soon the binders began to complain that these artificial leathers and waterproofed buckrams did not take gold leaf easily and offered trouble when it came to pasting down the end papers. The gold refused to stick, and sometimes it came off after the binder had let the run pass on as a satisfactory bit of gold lettering or decorating. It meant an increase in cost of binding when an increase in amount of care and attention was demanded from the binder.

Book varnishes and lacquers. To provide bindings that could be cleaned some binders choose to stick to the old-fashioned book cloths, and varnish or lacquer them before putting them in circulation. Good book varnishes or book lacquers can be had at any bookbinding supply house at moderate cost and in containers of sufficiently varied sizes to suit the needs of any customer. These varnishes or lacquers can be applied with a small piece of cotton, a brush, or if necessary with an air spray. The latter calls not only for power to run the blower, but also for space to house the equipment, and for an exhaust to outer air. Large plants can use this power spray with advantage, but for the smaller establishment hand work is usually sufficient.

The Treatment of Cloth Bindings

Varnishing or lacquering a book tends to make the covers waterproof, and covers so treated may be cleaned with a damp cloth. Water should not be used on regular book cloths unless they are protected in some way. If not they will certainly give up finish, filler, color, when water is applied.

Often a piece of art gum or a soft rubber eraser will prove a great help in cleaning books soiled by ordinary handling. Grease spots and deep-seated grime may sometimes be removed by benzene or benzole. The restoration of stained or faded book cloth is considered on page 50 of Chapter IV.

Would that all were agreed as to recognition of the perfect, non-soilable book cloth, bright and cheerful to look upon, happily responsive to hands of forwarder and finisher, easily cleaned when its non-soilable surface is showing just the suggestion of taint. The manufacturers may honestly believe their next effort will solve the problem, but those of us who watch books struggle with the hands of their readers and users are inclined to wait just a bit longer before going quite that far.

CHAPTER VIII

A List of References

THIS list of references to other books and articles is no "bibliography" as an essay at completeness. It is an effort to set forth some of the important works in this field that have come to mind during the more than a few years the compilers have given thought to the problems set forth in the preceding pages. Almost boundless opportunities of increasing the list are open to the ardent soul who wishes to dig deeper into the volumes on the making of books, paper, leather, and related topics.

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